

PRECISION SPEED REDUCER FOR ROBOTICS AND MANUFACTURING

FINAL REPORT

Appendicies

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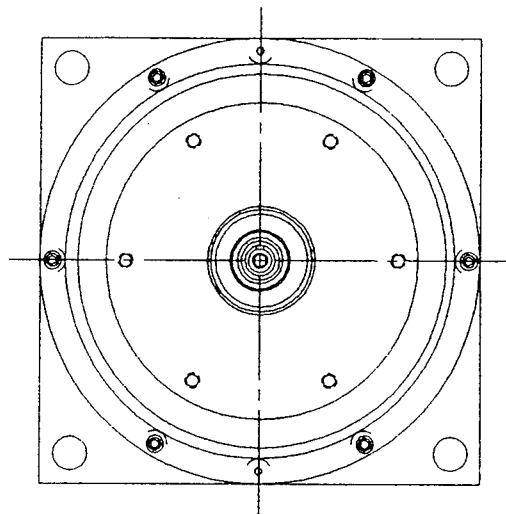
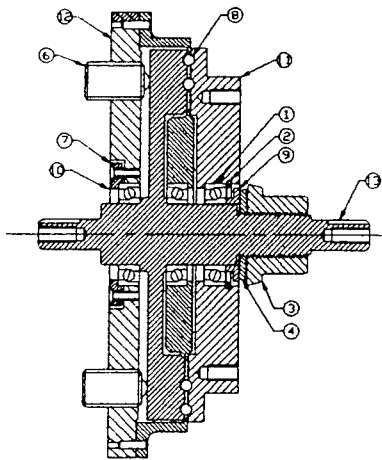
SYNKINETICS, INC. 01FEB95
Contract # DASG60-94-C-0098

19950213 059

Appendix-A: Drawings for ZBcam prototype test unit

Accession For	
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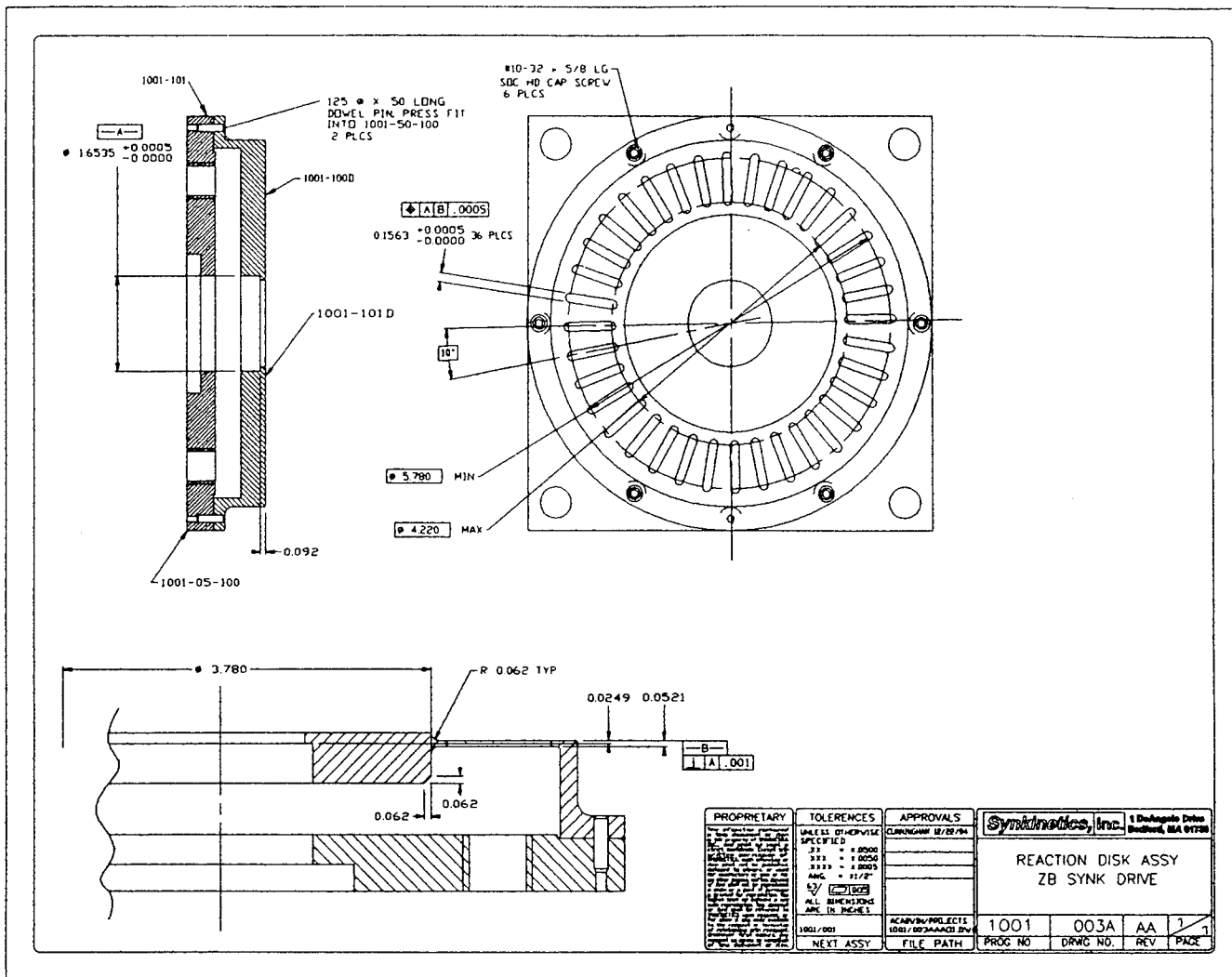
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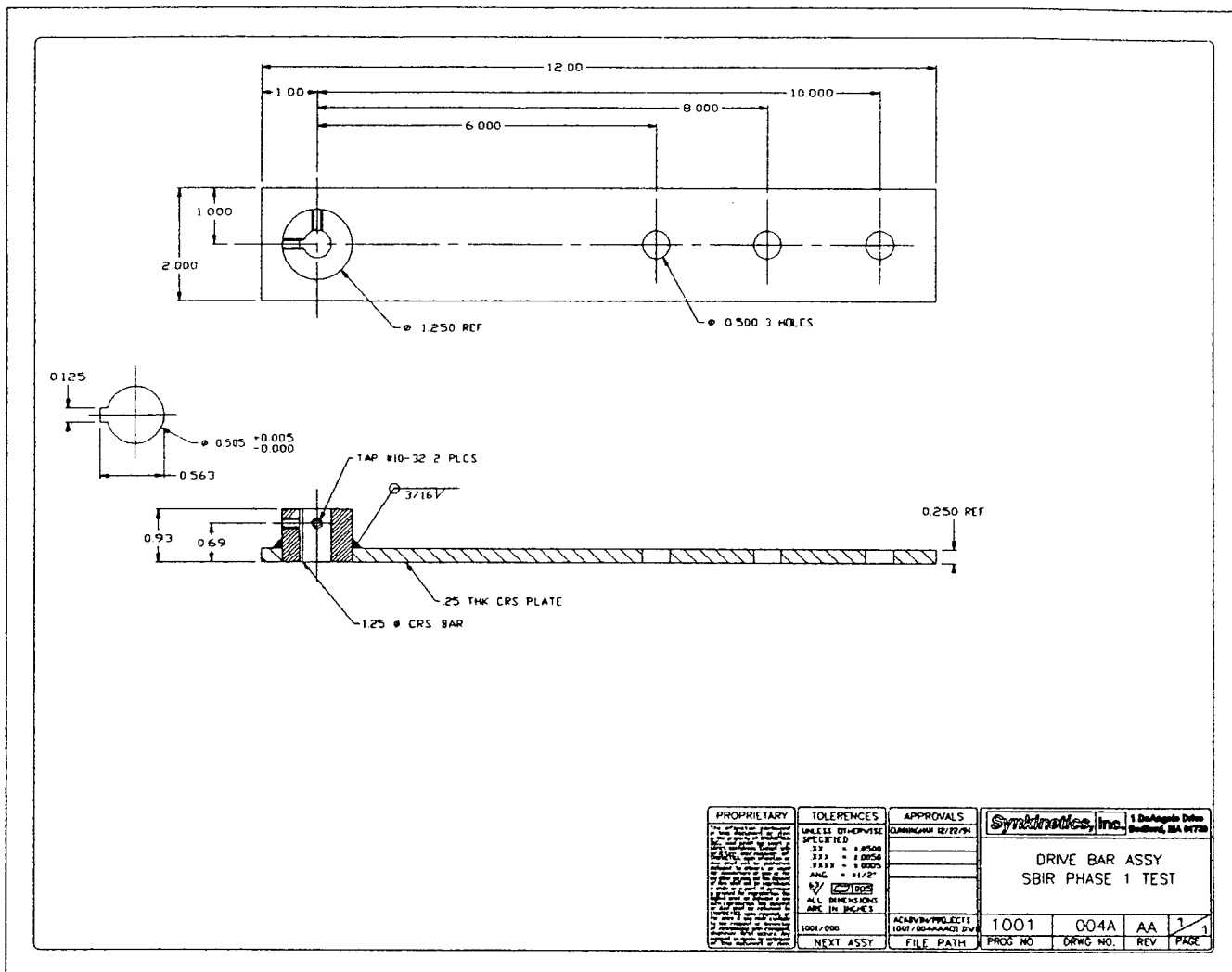


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			ZB SYNK DRIVE			
1001/800	1001/800/AA01 B.V.G.	1001/800	001A	AA	1	1
NEXT ASSY	FILE PATH	PROC NO	DRWG NO.	REV	PAGE	

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14							
13	1	000	1001-102D	DRIVE CAM / SHAFT			
12	1	000	1001-003A	REACTION DISK ASSY			
11	1	000	1001-103D	DRIVEN CAM			
10	1	000	1001-105D	RETAINER #2			
9	1	000	1001-104D	RETAINER #1			
8	72	?		5/32 DIA STEEL BALL			
7	6	001		#6-32 X 1/2 LG FLAT HD SCREW			
6	6	104	SSBH-62	BALL PLUNGER			
5	1	103	B1500-060	SPRING WASHER			
4	1	103	B1500-0455	SPRING WASHER			
3	1	102	91031A036	FLANGE NUT			
2	1	101	N5000-165	RETAINING RING			
1	3	100	71905CD	BEARING			
ITEM	QTY	MFG	PART NUMBER	DESCRIPTION			

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BILL OF MATERIALS																		
ZB SYNK DRIVE SBIR PHASE 1																		
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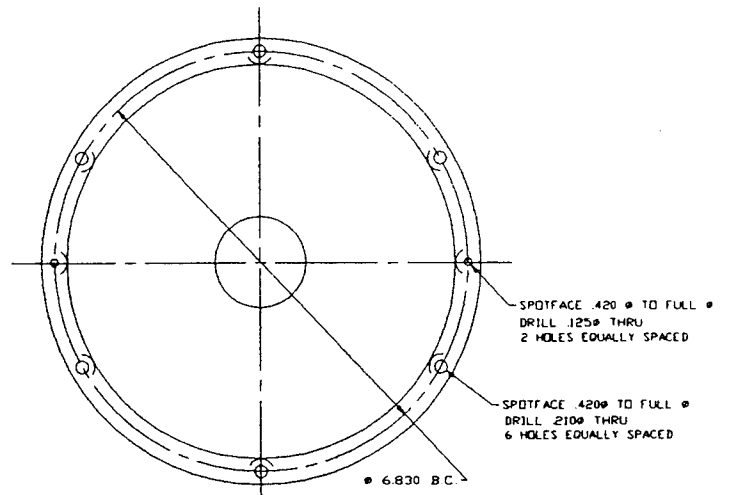
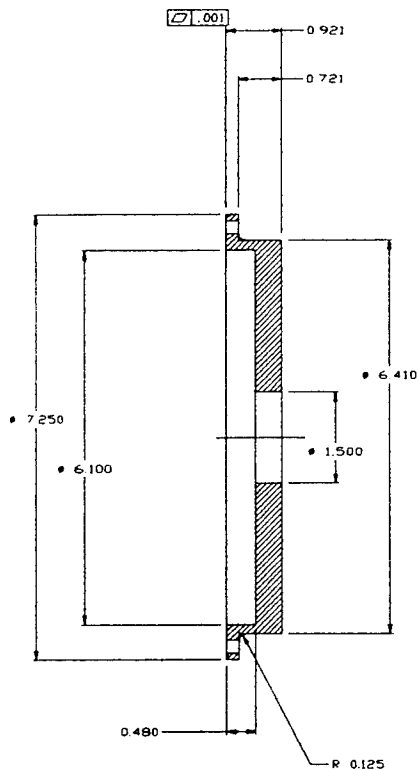




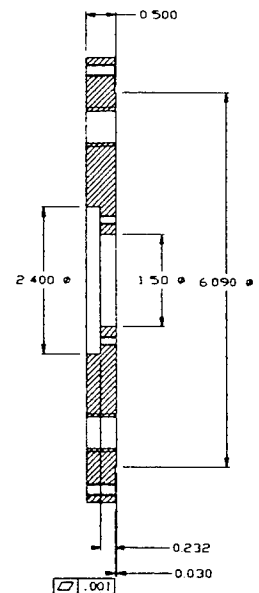
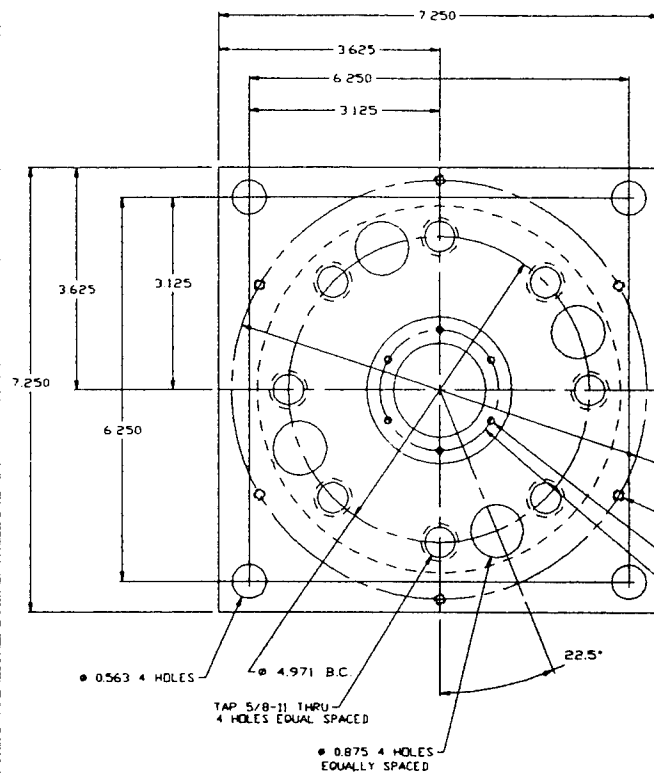
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23				
22	1	000	1001-106D	DRIVEN ARM
21	1	000	1001-004A	DRIVE BAR ASSY
20	4	000	1001-107D	FOOT
19	2	000	1001-108D	LOCK, DRIVEN ARM
18	2	000	1001-109D	LOCK, DRIVE ARM
17	1	000	1001-110D	PLATE
16	1	000	1001-001D	ZB SYNK DRIVE ASSY
15	1	102	1757T11	2LB SPRING SCALE
14	1	102	1757T22	50 LB SPRING SCALE
13	2	001		#10-32 X 3/8 LG SOC HD SET SCREW
12	12	001		1/4 LOCKWASHER
11	12	001		1/4-20 X 1 LG HHCS
10	4	001		3/8 LOCKWASHER
9	2	001		3/8-16 HEX NUT
8	6	001		3/8-16 X 1-1/4 LG HHCS
7	4	001		1/2 LOCKWASHER
6	4	001		1/2-13 X 1-1/4 LG HHCS
5	2	102	5033A5	6 INCH C-CLAMP
4	2	105	25-109J	DIAL INDICATOR
3	2	105	708AZ	DIAL INDICATOR
2	2	105	22429	DOVETAIL BODY CLAMP
1	4	105	657AA	MAGNETIC BASE INDICATOR HOLDER
ITEM	QTY	MFG	PART NUMBER	DESCRIPTION

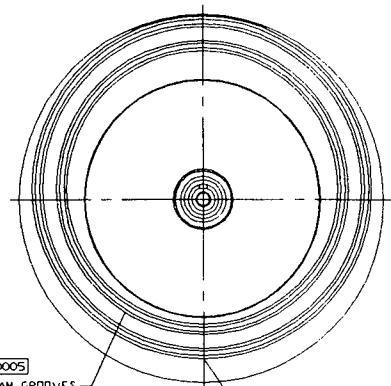
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UNLESS OTHERWISE SPECIFIED	3X ± 0.000	CLARK/JAN 12/22/94	REACTION DISK BLANK			
	3X ± 0.005		REACTION DISK ASSY			
	3X ± 0.000		ZB SYNK DRIVE			
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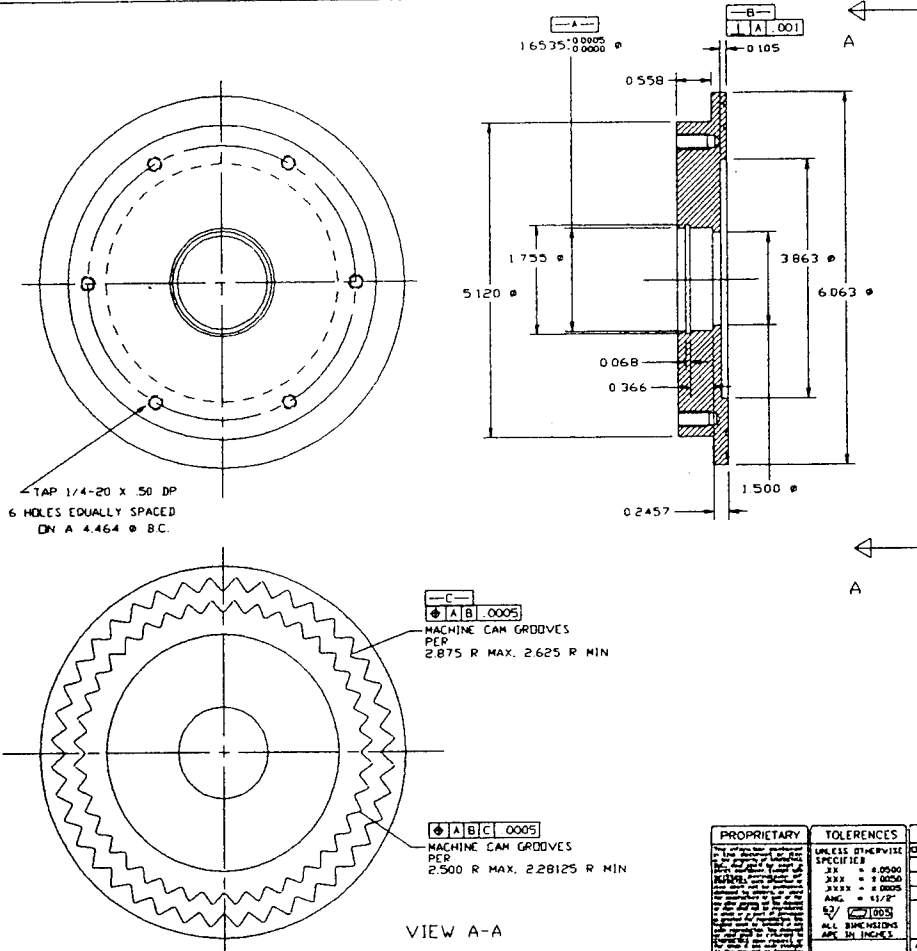
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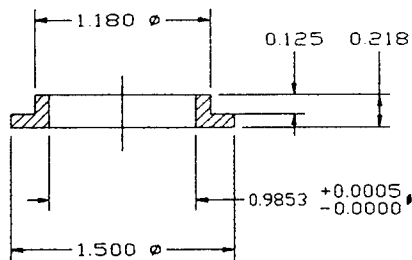
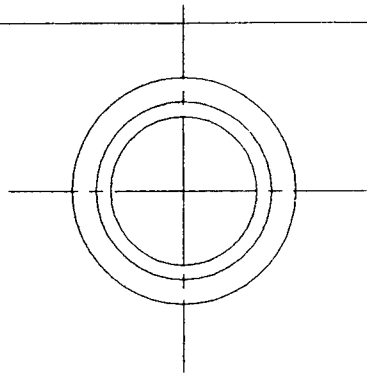
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2875 R MAX. 2625 R MIN



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DRIVE CAM / SHAFT ZB SYNK DRIVE			
1001/001 NEXT ASSY	HEADIN/PROJECTS 1001/10000000 FILE PATH	1001 102D PROG NO. DRWG NO.	AA REV 1 PAGE



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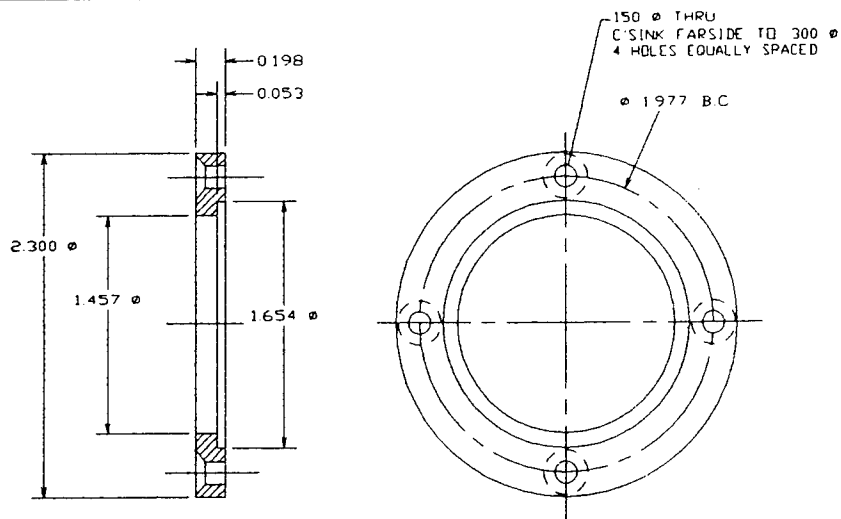


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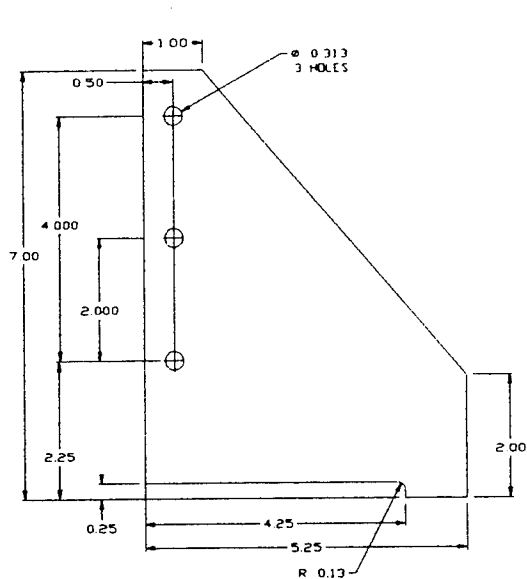
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ARE IN INCHES
ACADWIN/PROJECTS
1001/001
NEXT ASSY

APPROVALS
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ACADWIN/PROJECTS
1001/104DAA01.DWG
FILE PATH

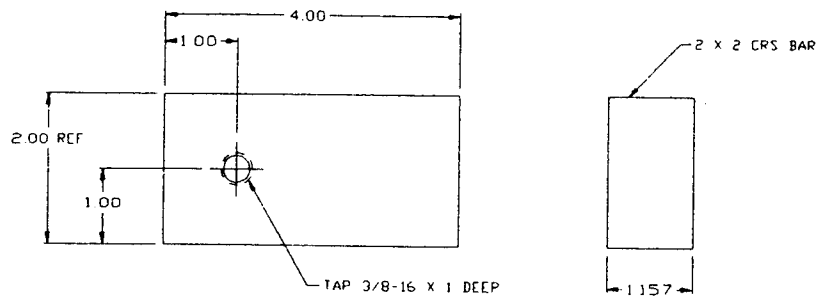
Synkinetics, Inc.		1 DeAngelo Drive Bedford, MA 01730	
RETAINER #1 ZB SYNK DRIVE			
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PROG NO	DRWG NO.	REV	PAGE



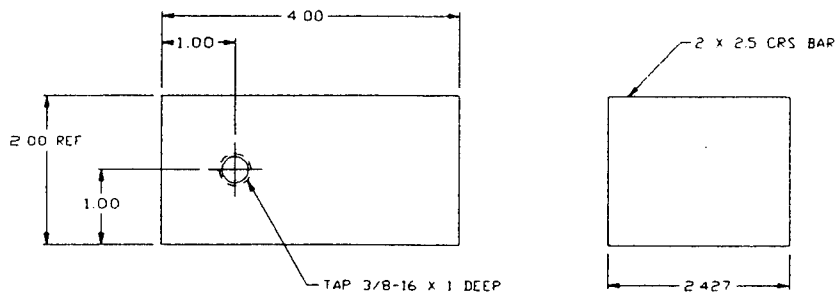
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PROG NO	DRWG NO.	REV	PAGE								



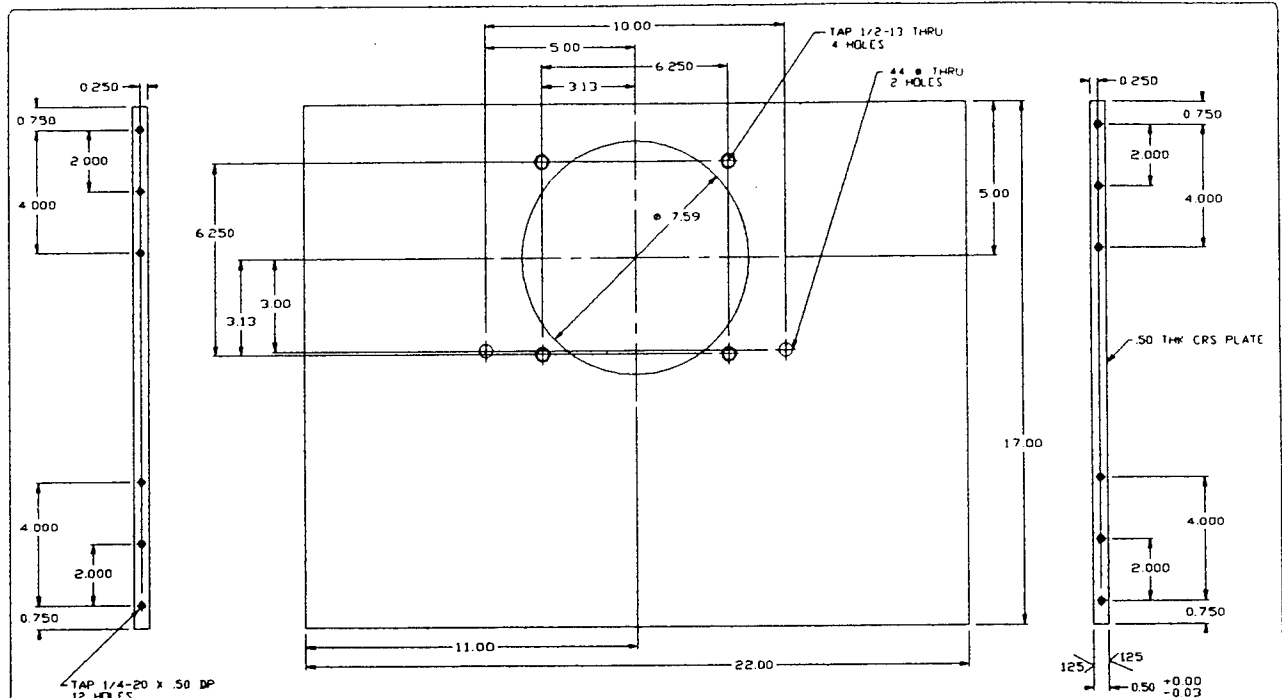
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1/32" ± 0.0005	1/32" ± 0.0005		1001	107D	AA	1
1/64" ± 0.0005	1/64" ± 0.0005		PROG NO	DRWG NO	REV	PAGE
ALL DIMENSIONS ARE IN INCHES	ALL DIMENSIONS ARE IN INCHES					
1001/002	1001/1670AADI 8/94					
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	<small> 1001/002 NEXT ASSY </small>	<small> ACADWIN/PROJECTS 1001/108DA01.DWG FILE PATH </small>	<small> 1001 PROG NO </small>	<small> 108D DRWG NO. </small>	<small> AA REV </small>	<small> 1 PAGE </small>



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	.XXX = ±.0050					
	.XXXX = ±.0005					
	ANG. = ±1/2°					
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	NEXT ASSY	FILE PATH				



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ALL DIMENSIONS ARE IN INCHES	3.0 = ±.0050					
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Appendix-B: Results for 40% Flank Angle and 52% Conformity

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 40 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter = 0.15625

ConformingDiameter = 0.1625

ConformingPercentage = 52.

PrimaryFlankAngleDegrees = 40.

IntermediateFlankAngleDegrees = 0.

SecondaryFlankAngleDegrees = 40.

PrimaryFractionBallDepth = 0.3

SecondaryFractionBallDepth = 0.3

ToleranceFraction = 0.01

ContactToCornerDistance for Dp = 0.0247607

ContactToCornerDistance for Ds = 0.0247607

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

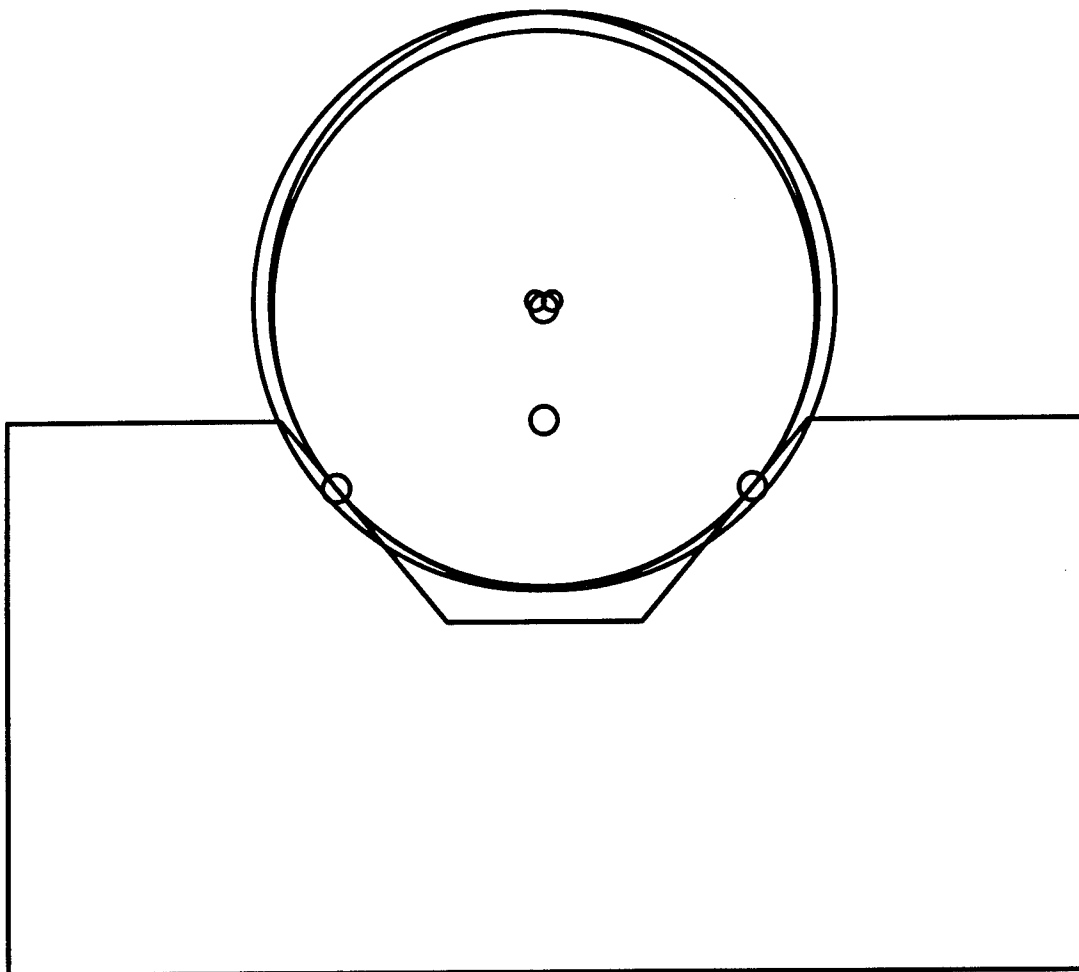
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition       = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta            = 1.
PrimaryAngleNumber           = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

=====

Summary of Stress and Displacement Calculations

=====

```

Calculated for kinematic solution : 6
Angular Deformation                 : 0.395194
Applied Torque                      : 1200.

```

=====

Ball number : 1
Ball angle : 350.
Ball position : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.2375
Residual Force Vector : {0.503809, 0.29151, -0.14441}

-6
Displacement Residual : 2.39583 10

Contact name : DpCo
Max Normal Load : 19.8801
Max Normal Stress : -224625.
Displacement : 0.000118592
Contact a-length : 0.0187847
Contact b-length : 0.00228422
Contact area : 0.000134801
Distance to Corner : 0.00597596
Effective Speed Factor : 2.659
Load-Life Factor : 10.7002

7
Expected Average Life : 4.98132 10

Contact name : DiCi
Max Normal Load : 14.9633
Max Normal Stress : -201057.
Displacement : 0.0000950073
Contact a-length : 0.0168134
Contact b-length : 0.00204444
Contact area : 0.000107989
Distance to Corner: Dp : 0.00943658
Distance to Corner: Ds : 0.00943658
Effective Speed Factor : 2.659
Load-Life Factor : 14.2161

8
Expected Average Life : 1.55205 10

Contact name : DsCi
Max Normal Load : 24.1761
Max Normal Stress : -238811.
Displacement : 0.000134022
Contact a-length : 0.0199695
Contact b-length : 0.00242802
Contact area : 0.000152324
Distance to Corner : 0.00479119
Effective Speed Factor : 2.659
Load-Life Factor : 8.79877

7
Expected Average Life : 2.27756 10

```

=====
Ball number      : 2
Ball angle       : 340.
Ball position    : {-0.640757, 2.39134, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.3348
Residual Force Vector : {0.435179, 0.371096, -0.145469}
Displacement Residual : 2.35975 10-6

```

```

Contact name      : DpCo
Max Normal Load   : 19.8138
Max Normal Stress : -224371.
Displacement      : 0.000118324
Contact a-length  : 0.0187635
Contact b-length  : 0.00228164
Contact area      : 0.000134496
Distance to Corner : 0.00599721
Effective Speed Factor : 2.659
Load-Life Factor  : 10.7359

```

```

Expected Average Life : 5.0483 107

```

```

Contact name      : DiCi
Max Normal Load   : 14.9524
Max Normal Stress : -201048.
Displacement      : 0.0000949982
Contact a-length  : 0.0168126
Contact b-length  : 0.00204434
Contact area      : 0.000107979
Distance to Corner: Dp : 0.00943738
Distance to Corner: Ds : 0.00943738
Effective Speed Factor : 2.659
Load-Life Factor  : 14.2265

```

```

Expected Average Life : 1.55658 108

```

```

Contact name      : DsCi
Max Normal Load   : 24.1244
Max Normal Stress : -238629.
Displacement      : 0.000133819
Contact a-length  : 0.0199543
Contact b-length  : 0.00242618
Contact area      : 0.000152093
Distance to Corner : 0.00480638
Effective Speed Factor : 2.659
Load-Life Factor  : 8.81762

```

```

Expected Average Life : 2.29715 107

```

```
=====
Ball number      : 3
Ball angle       : 330.
Ball position    : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.4324
Residual Force Vector : {0.354572, 0.435769, -0.146485}
Displacement Residual : 2.32368 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.7473
Max Normal Stress : -224115.
Displacement     : 0.000118054
Contact a-length : 0.0187421
Contact b-length : 0.00227904
Contact area     : 0.00013419
Distance to Corner : 0.00601858
Effective Speed Factor : 2.659
Load-Life Factor : 10.7721
Expected Average Life : 5.11662 107
****
Contact name     : DiCi
Max Normal Load  : 14.9413
Max Normal Stress : -201037.
Displacement     : 0.0000949882
Contact a-length : 0.0168117
Contact b-length : 0.00204424
Contact area     : 0.000107968
Distance to Corner: Dp : 0.00943827
Distance to Corner: Ds : 0.00943827
Effective Speed Factor : 2.659
Load-Life Factor : 14.237
Expected Average Life : 1.56121 108
****
Contact name     : DsCi
Max Normal Load  : 24.0725
Max Normal Stress : -238446.
Displacement     : 0.000133614
Contact a-length : 0.019939
Contact b-length : 0.00242432
Contact area     : 0.00015186
Distance to Corner : 0.00482167
Effective Speed Factor : 2.659
Load-Life Factor : 8.83665
Expected Average Life : 2.31705 107
```

```
=====
Ball number      : 4
Ball angle       : 320.
Ball position    : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.5304
Residual Force Vector : {0.265063, 0.48385, -0.147457}
Displacement Residual : 2.28764 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.6806
Max Normal Stress : -223858.
Displacement     : 0.000117784
Contact a-length : 0.0187206
Contact b-length : 0.00227643
Contact area     : 0.000133882
Distance to Corner : 0.00604008
Effective Speed Factor : 2.659
Load-Life Factor : 10.8086
Expected Average Life : 5.18632 107
****
Contact name     : DiCi
Max Normal Load  : 14.93
Max Normal Stress : -201026.
Displacement     : 0.0000949772
Contact a-length : 0.0168108
Contact b-length : 0.00204412
Contact area     : 0.000107955
Distance to Corner: Dp : 0.00943924
Distance to Corner: Ds : 0.00943924
Effective Speed Factor : 2.659
Load-Life Factor : 14.2478
Expected Average Life : 1.56594 108
****
Contact name     : DsCi
Max Normal Load  : 24.0202
Max Normal Stress : -238262.
Displacement     : 0.000133408
Contact a-length : 0.0199236
Contact b-length : 0.00242245
Contact area     : 0.000151626
Distance to Corner : 0.00483704
Effective Speed Factor : 2.659
Load-Life Factor : 8.85587
Expected Average Life : 2.33727 107
```

=====

Ball number : 5
Ball angle : 310.
Ball position : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.6288
Residual Force Vector : {0.16994, 0.514271, -0.148384}

Displacement Residual : 2.25163 10⁻⁶

Contact name : DpCo
Max Normal Load : 19.6138
Max Normal Stress : -223600.
Displacement : 0.000117512
Contact a-length : 0.018699
Contact b-length : 0.0022738
Contact area : 0.000133573
Distance to Corner : 0.0060617
Effective Speed Factor : 2.659
Load-Life Factor : 10.8454

Expected Average Life : 5.25743 10⁷

Contact name : DiCi
Max Normal Load : 14.9185
Max Normal Stress : -201013.
Displacement : 0.0000949653
Contact a-length : 0.0168097
Contact b-length : 0.00204399
Contact area : 0.000107942
Distance to Corner: Dp : 0.00944029
Distance to Corner: Ds : 0.00944029
Effective Speed Factor : 2.659
Load-Life Factor : 14.2588

Expected Average Life : 1.57077 10⁸

Contact name : DsCi
Max Normal Load : 23.9677
Max Normal Stress : -238077.
Displacement : 0.000133201
Contact a-length : 0.0199082
Contact b-length : 0.00242057
Contact area : 0.00015139
Distance to Corner : 0.00485251
Effective Speed Factor : 2.659
Load-Life Factor : 8.87527

Expected Average Life : 2.35782 10⁷


```
=====
Ball number      : 6
Ball angle       : 300.
Ball position     : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 37.7277
Residual Force Vector : {0.0725791, 0.526594, -0.149265}
Displacement Residual : 2.21565 10-6
****
Contact name      : DpCo
Max Normal Load   : 19.5467
Max Normal Stress  : -223340.
Displacement      : 0.000117239
Contact a-length  : 0.0186772
Contact b-length  : 0.00227115
Contact area      : 0.000133263
Distance to Corner : 0.00608345
Effective Speed Factor : 2.659
Load-Life Factor   : 10.8827
Expected Average Life : 5.32997 107
****
Contact name      : DiCi
Max Normal Load   : 14.9068
Max Normal Stress  : -200999.
Displacement      : 0.0000949525
Contact a-length  : 0.0168086
Contact b-length  : 0.00204385
Contact area      : 0.000107927
Distance to Corner: Dp : 0.00944143
Distance to Corner: Ds : 0.00944143
Effective Speed Factor : 2.659
Load-Life Factor   : 14.27
Expected Average Life : 1.5757 108
****
Contact name      : DsCi
Max Normal Load   : 23.9149
Max Normal Stress  : -237891.
Displacement      : 0.000132992
Contact a-length  : 0.0198926
Contact b-length  : 0.00241868
Contact area      : 0.000151154
Distance to Corner : 0.00486807
Effective Speed Factor : 2.659
Load-Life Factor   : 8.89487
Expected Average Life : 2.37871 107
```

```
=====
Ball number          : 7
Ball angle           : 290.
Ball position        : {-2.18867, 1.02059, 0.}
Solution current?    : Yes
Ball activity        : ON
Ball request         : solve
Cross over angle     : 37.8269
Residual Force Vector : {-0.0236712, 0.521014, -0.150101}
Displacement Residual : 2.17969 10-6
****
Contact name         : DpCo
Max Normal Load      : 19.4794
Max Normal Stress     : -223078.
Displacement         : 0.000116964
Contact a-length     : 0.0186554
Contact b-length     : 0.00226849
Contact area         : 0.000132951
Distance to Corner   : 0.00610533
Effective Speed Factor : 2.659
Load-Life Factor     : 10.9203
Expected Average Life : 5.404 107
****
Contact name         : DiCi
Max Normal Load      : 14.8949
Max Normal Stress     : -200985.
Displacement         : 0.0000949387
Contact a-length     : 0.0168074
Contact b-length     : 0.0020437
Contact area         : 0.000107911
Distance to Corner: Dp : 0.00944265
Distance to Corner: Ds : 0.00944265
Effective Speed Factor : 2.659
Load-Life Factor     : 14.2814
Expected Average Life : 1.58075 108
****
Contact name         : DsCi
Max Normal Load      : 23.8619
Max Normal Stress     : -237704.
Displacement         : 0.000132783
Contact a-length     : 0.019877
Contact b-length     : 0.00241677
Contact area         : 0.000150916
Distance to Corner   : 0.00488373
Effective Speed Factor : 2.659
Load-Life Factor     : 8.91465
Expected Average Life : 2.39994 107
```

=====

Ball number : 8
 Ball angle : 280.
 Ball position : {-2.32091, 0.621885, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.9266
 Residual Force Vector : {-0.115604, 0.498326, -0.150889}

Displacement Residual : 2.14377 10⁻⁶

Contact name : DpCo
 Max Normal Load : 19.4119
 Max Normal Stress : -222815.
 Displacement : 0.000116688
 Contact a-length : 0.0186333
 Contact b-length : 0.00226581
 Contact area : 0.000132637
 Distance to Corner : 0.00612733
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.9582

Expected Average Life : 5.47954 10⁷

Contact name : DiCi
 Max Normal Load : 14.8828
 Max Normal Stress : -200969.
 Displacement : 0.000094924
 Contact a-length : 0.016806
 Contact b-length : 0.00204355
 Contact area : 0.000107895
 Distance to Corner: Dp : 0.00944396
 Distance to Corner: Ds : 0.00944396
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.293

Expected Average Life : 1.5859 10⁸

Contact name : DsCi
 Max Normal Load : 23.8085
 Max Normal Stress : -237516.
 Displacement : 0.000132573
 Contact a-length : 0.0198612
 Contact b-length : 0.00241486
 Contact area : 0.000150677
 Distance to Corner : 0.00489948
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.93462

Expected Average Life : 2.42152 10⁷

```
=====
Ball number      : 9
Ball angle       : 270.
Ball position     : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 38.0267
Residual Force Vector : {-0.200263, 0.459886, -0.151629}
Displacement Residual : 2.10788 10-6
****
Contact name      : DpCo
Max Normal Load   : 19.3442
Max Normal Stress : -222551.
Displacement      : 0.000116411
Contact a-length  : 0.0186112
Contact b-length  : 0.00226312
Contact area      : 0.000132322
Distance to Corner : 0.00614947
Effective Speed Factor : 2.659
Load-Life Factor  : 10.9966
Expected Average Life : 5.55663 107
****
Contact name      : DiCi
Max Normal Load   : 14.8705
Max Normal Stress : -200953.
Displacement      : 0.0000949082
Contact a-length  : 0.0168047
Contact b-length  : 0.00204338
Contact area      : 0.000107877
Distance to Corner: Dp : 0.00944535
Distance to Corner: Ds : 0.00944535
Effective Speed Factor : 2.659
Load-Life Factor  : 14.3048
Expected Average Life : 1.59116 108
****
Contact name      : DsCi
Max Normal Load   : 23.7549
Max Normal Stress : -237326.
Displacement      : 0.000132361
Contact a-length  : 0.0198454
Contact b-length  : 0.00241293
Contact area      : 0.000150437
Distance to Corner : 0.00491532
Effective Speed Factor : 2.659
Load-Life Factor  : 8.95479
Expected Average Life : 2.44346 107
```

```
=====
Ball number      : 10
Ball angle       : 260.
Ball position    : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.1272
Residual Force Vector : {-0.275033, 0.407548, -0.15232}
Displacement Residual : 2.07203 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.2763
Max Normal Stress : -222284.
Displacement     : 0.000116133
Contact a-length : 0.0185889
Contact b-length : 0.00226042
Contact area     : 0.000132006
Distance to Corner : 0.00617173
Effective Speed Factor : 2.659
Load-Life Factor : 11.0353
Expected Average Life : 5.63531 107
****
Contact name     : DiCi
Max Normal Load  : 14.858
Max Normal Stress : -200935.
Displacement     : 0.0000948915
Contact a-length : 0.0168032
Contact b-length : 0.0020432
Contact area     : 0.000107858
Distance to Corner: Dp : 0.00944683
Distance to Corner: Ds : 0.00944683
Effective Speed Factor : 2.659
Load-Life Factor : 14.3169
Expected Average Life : 1.59653 108
****
Contact name     : DsCi
Max Normal Load  : 23.701
Max Normal Stress : -237136.
Displacement     : 0.000132149
Contact a-length : 0.0198294
Contact b-length : 0.00241099
Contact area     : 0.000150195
Distance to Corner : 0.00493126
Effective Speed Factor : 2.659
Load-Life Factor : 8.97516
Expected Average Life : 2.46577 107
```

=====

Ball number : 11
Ball angle : 250.
Ball position : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 38.2281
Residual Force Vector : {-0.337724, 0.343581, -0.152961}

-6
Displacement Residual : 2.03622 10

Contact name : DpCo
Max Normal Load : 19.2083
Max Normal Stress : -222017.
Displacement : 0.000115853
Contact a-length : 0.0185666
Contact b-length : 0.00225769
Contact area : 0.000131688
Distance to Corner : 0.00619413
Effective Speed Factor : 2.659
Load-Life Factor : 11.0744

7
Expected Average Life : 5.71562 10

Contact name : DiCi
Max Normal Load : 14.8453
Max Normal Stress : -200916.
Displacement : 0.0000948738
Contact a-length : 0.0168016
Contact b-length : 0.00204301
Contact area : 0.000107838
Distance to Corner: Dp : 0.00944839
Distance to Corner: Ds : 0.00944839
Effective Speed Factor : 2.659
Load-Life Factor : 14.3292

8
Expected Average Life : 1.60202 10

Contact name : DsCi
Max Normal Load : 23.6468
Max Normal Stress : -236944.
Displacement : 0.000131935
Contact a-length : 0.0198134
Contact b-length : 0.00240904
Contact area : 0.000149952
Distance to Corner : 0.00494729
Effective Speed Factor : 2.659
Load-Life Factor : 8.99573

7
Expected Average Life : 2.48845 10

```
=====
Ball number      : 12
Ball angle       : 240.
Ball position    : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.3294
Residual Force Vector : {-0.386636, 0.270583, -0.153551}
Displacement Residual : 2.00045 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.14
Max Normal Stress : -221747.
Displacement     : 0.000115572
Contact a-length : 0.018544
Contact b-length : 0.00225495
Contact area     : 0.000131369
Distance to Corner : 0.00621665
Effective Speed Factor : 2.659
Load-Life Factor : 11.1139
Expected Average Life : 5.7976 107
****
Contact name     : DiCi
Max Normal Load  : 14.8323
Max Normal Stress : -200896.
Displacement     : 0.0000948551
Contact a-length : 0.0168
Contact b-length : 0.0020428
Contact area     : 0.000107816
Distance to Corner: Dp : 0.00945005
Distance to Corner: Ds : 0.00945005
Effective Speed Factor : 2.659
Load-Life Factor : 14.3417
Expected Average Life : 1.60762 108
****
Contact name     : DsCi
Max Normal Load  : 23.5923
Max Normal Stress : -236751.
Displacement     : 0.000131721
Contact a-length : 0.0197973
Contact b-length : 0.00240708
Contact area     : 0.000149708
Distance to Corner : 0.00496342
Effective Speed Factor : 2.659
Load-Life Factor : 9.0165
Expected Average Life : 2.51151 107
```

```
=====
Ball number      : 13
Ball angle       : 230.
Ball position    : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.4311
Residual Force Vector : {-0.420598, 0.191376, -0.15409}
Displacement Residual : 1.96472 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.0715
Max Normal Stress : -221476.
Displacement     : 0.00011529
Contact a-length : 0.0185214
Contact b-length : 0.0022522
Contact area     : 0.000131048
Distance to Corner : 0.00623931
Effective Speed Factor : 2.659
Load-Life Factor : 11.1538
Expected Average Life : 5.8813 107
****
Contact name     : DiCi
Max Normal Load  : 14.8191
Max Normal Stress : -200875.
Displacement     : 0.0000948354
Contact a-length : 0.0167982
Contact b-length : 0.00204259
Contact area     : 0.000107794
Distance to Corner: Dp : 0.0094518
Distance to Corner: Ds : 0.0094518
Effective Speed Factor : 2.659
Load-Life Factor : 14.3544
Expected Average Life : 1.61333 108
****
Contact name     : DsCi
Max Normal Load  : 23.5375
Max Normal Stress : -236557.
Displacement     : 0.000131505
Contact a-length : 0.019781
Contact b-length : 0.00240511
Contact area     : 0.000149463
Distance to Corner : 0.00497965
Effective Speed Factor : 2.659
Load-Life Factor : 9.03748
Expected Average Life : 2.53497 107
```



```
=====
Ball number      : 14
Ball angle       : 220.
Ball position     : {-1.64746, -1.64746, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 38.5333
Residual Force Vector : {-0.438999, 0.108905, -0.154576}
Displacement Residual : 1.92904 10-6
****
Contact name      : DpCo
Max Normal Load   : 19.0029
Max Normal Stress : -221204.
Displacement      : 0.000115007
Contact a-length  : 0.0184986
Contact b-length  : 0.00224943
Contact area      : 0.000130725
Distance to Corner : 0.0062621
Effective Speed Factor : 2.659
Load-Life Factor  : 11.1941
Expected Average Life : 5.96675 107
****
Contact name      : DiCi
Max Normal Load   : 14.8058
Max Normal Stress : -200853.
Displacement      : 0.0000948147
Contact a-length  : 0.0167964
Contact b-length  : 0.00204237
Contact area      : 0.00010777
Distance to Corner: Dp : 0.00945363
Distance to Corner: Ds : 0.00945363
Effective Speed Factor : 2.659
Load-Life Factor  : 14.3674
Expected Average Life : 1.61917 108
****
Contact name      : DsCi
Max Normal Load   : 23.4825
Max Normal Stress : -236362.
Displacement      : 0.000131288
Contact a-length  : 0.0197647
Contact b-length  : 0.00240312
Contact area      : 0.000149216
Distance to Corner : 0.00499597
Effective Speed Factor : 2.659
Load-Life Factor  : 9.05866
Expected Average Life : 2.55882 107
```

=====
Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 38.6358
Residual Force Vector : {-0.441789, 0.0261266, -0.155009}
Displacement Residual : 1.8934 10⁻⁶

Contact name : DpCo
Max Normal Load : 18.9341
Max Normal Stress : -220930.
Displacement : 0.000114722
Contact a-length : 0.0184757
Contact b-length : 0.00224664
Contact area : 0.000130402
Distance to Corner : 0.00628502
Effective Speed Factor : 2.659
Load-Life Factor : 11.2348

Expected Average Life : 6.054 10⁷

Contact name : DiCi
Max Normal Load : 14.7922
Max Normal Stress : -200830.
Displacement : 0.0000947929
Contact a-length : 0.0167944
Contact b-length : 0.00204213
Contact area : 0.000107746
Distance to Corner: Dp : 0.00945556
Distance to Corner: Ds : 0.00945556
Effective Speed Factor : 2.659
Load-Life Factor : 14.3806

Expected Average Life : 1.62513 10⁸

Contact name : DsCi
Max Normal Load : 23.4272
Max Normal Stress : -236165.
Displacement : 0.00013107
Contact a-length : 0.0197483
Contact b-length : 0.00240113
Contact area : 0.000148969
Distance to Corner : 0.0050124
Effective Speed Factor : 2.659
Load-Life Factor : 9.08006

Expected Average Life : 2.58308 10⁷

```
=====
Ball number      : 16
Ball angle       : 200.
Ball position    : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.7388
Residual Force Vector : {-0.429466, -0.0540916, -0.155388}
Displacement Residual : 1.85782 10-6
****
Contact name     : DpCo
Max Normal Load  : 18.865
Max Normal Stress : -220654.
Displacement     : 0.000114436
Contact a-length : 0.0184526
Contact b-length : 0.00224383
Contact area     : 0.000130076
Distance to Corner : 0.00630807
Effective Speed Factor : 2.659
Load-Life Factor : 11.2759
Expected Average Life : 6.1431 107
****
Contact name     : DiCi
Max Normal Load  : 14.7784
Max Normal Stress : -200806.
Displacement     : 0.0000947701
Contact a-length : 0.0167924
Contact b-length : 0.00204189
Contact area     : 0.00010772
Distance to Corner: Dp : 0.00945758
Distance to Corner: Ds : 0.00945758
Effective Speed Factor : 2.659
Load-Life Factor : 14.394
Expected Average Life : 1.63121 108
****
Contact name     : DsCi
Max Normal Load  : 23.3716
Max Normal Stress : -235968.
Displacement     : 0.00013085
Contact a-length : 0.0197318
Contact b-length : 0.00239912
Contact area     : 0.000148719
Distance to Corner : 0.00502892
Effective Speed Factor : 2.659
Load-Life Factor : 9.10166
Expected Average Life : 2.60775 107
```

```
=====
Ball number      : 17
Ball angle       : 190.
Ball position    : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.8422
Residual Force Vector : {-0.403037, -0.129072, -0.155712}
Displacement Residual : 1.82228 10-6
****
Contact name     : DpCo
Max Normal Load  : 18.7958
Max Normal Stress : -220377.
Displacement     : 0.000114148
Contact a-length : 0.0184294
Contact b-length : 0.00224101
Contact area     : 0.00012975
Distance to Corner : 0.00633126
Effective Speed Factor : 2.659
Load-Life Factor : 11.3174
Expected Average Life : 6.23409 107
****
Contact name     : DiCi
Max Normal Load  : 14.7644
Max Normal Stress : -200781.
Displacement     : 0.0000947462
Contact a-length : 0.0167903
Contact b-length : 0.00204163
Contact area     : 0.000107693
Distance to Corner: Dp : 0.0094597
Distance to Corner: Ds : 0.0094597
Effective Speed Factor : 2.659
Load-Life Factor : 14.4077
Expected Average Life : 1.63741 108
****
Contact name     : DsCi
Max Normal Load  : 23.3156
Max Normal Stress : -235769.
Displacement     : 0.00013063
Contact a-length : 0.0197151
Contact b-length : 0.0023971
Contact area     : 0.000148469
Distance to Corner : 0.00504553
Effective Speed Factor : 2.659
Load-Life Factor : 9.12349
Expected Average Life : 2.63286 107
```

=====

Ball number : 18
Ball angle : 180.
Ball position : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.7656
Residual Force Vector : {-0.0739164, -0.00322451, 0.010387}
Displacement Residual : 2.78822 10⁻⁷

Contact name : DpCi
Max Normal Load : 20.5737
Max Normal Stress : -226110.
Displacement : 0.000120154
Contact a-length : 0.0189081
Contact b-length : 0.00229907
Contact area : 0.000136568
Distance to Corner : 0.00585262
Effective Speed Factor : 2.659
Load-Life Factor : 10.3394

Expected Average Life : 4.34281 10⁷

Contact name : DiCi
Max Normal Load : 13.0052
Max Normal Stress : -193714.
Displacement : 0.0000881938
Contact a-length : 0.0161993
Contact b-length : 0.00196977
Contact area : 0.000100245
Distance to Corner: Dp : 0.0100507
Distance to Corner: Ds : 0.0100507
Effective Speed Factor : 2.659
Load-Life Factor : 16.3566

Expected Average Life : 2.71989 10⁸

Contact name : DsCo
Max Normal Load : 25.2102
Max Normal Stress : -241976.
Displacement : 0.000137629
Contact a-length : 0.0202363
Contact b-length : 0.00246084
Contact area : 0.000156446
Distance to Corner : 0.00452437
Effective Speed Factor : 2.659
Load-Life Factor : 8.43785

Expected Average Life : 1.92624 10⁷

```
=====
Ball number      : 19
Ball angle       : 170.
Ball position    : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.66
Residual Force Vector : {-0.0727338, -0.0159131, 0.0102101}
Displacement Residual : 2.81512 10-7
****
Contact name     : DpCi
Max Normal Load  : 20.652
Max Normal Stress : -226398.
Displacement     : 0.00012046
Contact a-length : 0.0189321
Contact b-length : 0.00230199
Contact area     : 0.000136915
Distance to Corner : 0.00582859
Effective Speed Factor : 2.659
Load-Life Factor : 10.3002
Expected Average Life : 4.27731 107
****
Contact name     : DiCi
Max Normal Load  : 13.0017
Max Normal Stress : -193694.
Displacement     : 0.0000881756
Contact a-length : 0.0161976
Contact b-length : 0.00196957
Contact area     : 0.000100224
Distance to Corner: Dp : 0.0100524
Distance to Corner: Ds : 0.0100524
Effective Speed Factor : 2.659
Load-Life Factor : 16.3609
Expected Average Life : 2.7228 108
****
Contact name     : DsCo
Max Normal Load  : 25.2747
Max Normal Stress : -242182.
Displacement     : 0.000137863
Contact a-length : 0.0202535
Contact b-length : 0.00246293
Contact area     : 0.000156712
Distance to Corner : 0.00450714
Effective Speed Factor : 2.659
Load-Life Factor : 8.41631
Expected Average Life : 1.90665 107
```

```
=====
Ball number      : 20
Ball angle       : 160.
Ball position    : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.5549
Residual Force Vector : {-0.0693725, -0.0282938, 0.0100355}
                                     -7
Displacement Residual : 2.8419 10
****
Contact name      : DpCi
Max Normal Load   : 20.73
Max Normal Stress : -226683.
Displacement      : 0.000120764
Contact a-length  : 0.018956
Contact b-length  : 0.00230489
Contact area      : 0.000137261
Distance to Corner : 0.0058047
Effective Speed Factor : 2.659
Load-Life Factor  : 10.2614
                                     7
Expected Average Life : 4.21326 10
****
Contact name      : DiCi
Max Normal Load   : 12.998
Max Normal Stress : -193673.
Displacement      : 0.0000881562
Contact a-length  : 0.0161959
Contact b-length  : 0.00196935
Contact area      : 0.000100202
Distance to Corner: Dp : 0.0100541
Distance to Corner: Ds : 0.0100541
Effective Speed Factor : 2.659
Load-Life Factor  : 16.3656
                                     8
Expected Average Life : 2.72593 10
****
Contact name      : DsCo
Max Normal Load   : 25.3389
Max Normal Stress : -242387.
Displacement      : 0.000138096
Contact a-length  : 0.0202707
Contact b-length  : 0.00246502
Contact area      : 0.000156978
Distance to Corner : 0.00449002
Effective Speed Factor : 2.659
Load-Life Factor  : 8.39499
                                     7
Expected Average Life : 1.8874 10
```

=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.4502
Residual Force Vector : {-0.063903, -0.0399921, 0.0098633}

-7
Displacement Residual : 2.86857 10

Contact name : DpCi
Max Normal Load : 20.8078
Max Normal Stress : -226967.
Displacement : 0.000121067
Contact a-length : 0.0189797
Contact b-length : 0.00230778
Contact area : 0.000137605
Distance to Corner : 0.00578095
Effective Speed Factor : 2.659
Load-Life Factor : 10.2231

7
Expected Average Life : 4.15062 10

Contact name : DiCi
Max Normal Load : 12.994
Max Normal Stress : -193650.
Displacement : 0.0000881358
Contact a-length : 0.016194
Contact b-length : 0.00196912
Contact area : 0.000100179
Distance to Corner: Dp : 0.010056
Distance to Corner: Ds : 0.010056
Effective Speed Factor : 2.659
Load-Life Factor : 16.3706

8
Expected Average Life : 2.72926 10

Contact name : DsCo
Max Normal Load : 25.4028
Max Normal Stress : -242590.
Displacement : 0.000138328
Contact a-length : 0.0202877
Contact b-length : 0.00246708
Contact area : 0.000157241
Distance to Corner : 0.00447301
Effective Speed Factor : 2.659
Load-Life Factor : 8.37387

7
Expected Average Life : 1.86848 10

=====

Ball number : 22
Ball angle : 140.
Ball position : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.346
Residual Force Vector : {-0.0564603, -0.0506487, 0.00969339}

-7
Displacement Residual : 2.8951 10

Contact name : DpCi
Max Normal Load : 20.8853
Max Normal Stress : -227250.
Displacement : 0.000121368
Contact a-length : 0.0190033
Contact b-length : 0.00231065
Contact area : 0.000137948
Distance to Corner : 0.00575735
Effective Speed Factor : 2.659
Load-Life Factor : 10.1852

7
Expected Average Life : 4.08936 10

Contact name : DiCi
Max Normal Load : 12.9898
Max Normal Stress : -193626.
Displacement : 0.0000881143
Contact a-length : 0.016192
Contact b-length : 0.00196888
Contact area : 0.000100154
Distance to Corner: Dp : 0.010058
Distance to Corner: Ds : 0.010058
Effective Speed Factor : 2.659
Load-Life Factor : 16.3759

8
Expected Average Life : 2.7328 10

Contact name : DsCo
Max Normal Load : 25.4665
Max Normal Stress : -242793.
Displacement : 0.000138559
Contact a-length : 0.0203046
Contact b-length : 0.00246914
Contact area : 0.000157503
Distance to Corner : 0.0044561
Effective Speed Factor : 2.659
Load-Life Factor : 8.35295

7
Expected Average Life : 1.84988 10

=====

Ball number : 23
Ball angle : 130.
Ball position : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.2421
Residual Force Vector : {-0.0472407, -0.0599305, 0.00952573}
Displacement Residual : 2.92152 10⁻⁷

Contact name : DpCi
Max Normal Load : 20.9625
Max Normal Stress : -227530.
Displacement : 0.000121668
Contact a-length : 0.0190268
Contact b-length : 0.0023135
Contact area : 0.000138288
Distance to Corner : 0.00573389
Effective Speed Factor : 2.659
Load-Life Factor : 10.1476

Expected Average Life : 4.02944 10⁷

Contact name : DiCi
Max Normal Load : 12.9853
Max Normal Stress : -193602.
Displacement : 0.0000880917
Contact a-length : 0.0161899
Contact b-length : 0.00196863
Contact area : 0.000100129
Distance to Corner: Dp : 0.0100601
Distance to Corner: Ds : 0.0100601
Effective Speed Factor : 2.659
Load-Life Factor : 16.3816

Expected Average Life : 2.73656 10⁸

Contact name : DsCo
Max Normal Load : 25.5298
Max Normal Stress : -242993.
Displacement : 0.000138788
Contact a-length : 0.0203214
Contact b-length : 0.00247118
Contact area : 0.000157764
Distance to Corner : 0.00443931
Effective Speed Factor : 2.659
Load-Life Factor : 8.33224

Expected Average Life : 1.8316 10⁷

=====

Ball number : 24
Ball angle : 120.
Ball position : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.1387
Residual Force Vector : {-0.0364967, -0.0675411, 0.00936028}
Displacement Residual : 2.94781 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.0394
Max Normal Stress : -227809.
Displacement : 0.000121966
Contact a-length : 0.0190501
Contact b-length : 0.00231634
Contact area : 0.000138627
Distance to Corner : 0.00571057
Effective Speed Factor : 2.659
Load-Life Factor : 10.1105

Expected Average Life : 3.97082 10⁷

Contact name : DiCi
Max Normal Load : 12.9806
Max Normal Stress : -193576.
Displacement : 0.000088068
Contact a-length : 0.0161878
Contact b-length : 0.00196836
Contact area : 0.000100102
Distance to Corner: Dp : 0.0100622
Distance to Corner: Ds : 0.0100622
Effective Speed Factor : 2.659
Load-Life Factor : 16.3875

Expected Average Life : 2.74051 10⁸

Contact name : DsCo
Max Normal Load : 25.5928
Max Normal Stress : -243193.
Displacement : 0.000139016
Contact a-length : 0.0203381
Contact b-length : 0.00247321
Contact area : 0.000158023
Distance to Corner : 0.00442262
Effective Speed Factor : 2.659
Load-Life Factor : 8.31172

Expected Average Life : 1.81362 10⁷

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.0357
Residual Force Vector : {-0.0245303, -0.0732304, 0.00919699}
Displacement Residual : 2.97397 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.1161
Max Normal Stress : -228086.
Displacement : 0.000122263
Contact a-length : 0.0190733
Contact b-length : 0.00231916
Contact area : 0.000138965
Distance to Corner : 0.00568739
Effective Speed Factor : 2.659
Load-Life Factor : 10.0738

Expected Average Life : 3.91346 10⁷

Contact name : DiCi
Max Normal Load : 12.9757
Max Normal Stress : -193548.
Displacement : 0.0000880433
Contact a-length : 0.0161855
Contact b-length : 0.00196809
Contact area : 0.000100074
Distance to Corner: Dp : 0.0100645
Distance to Corner: Ds : 0.0100645
Effective Speed Factor : 2.659
Load-Life Factor : 16.3937

Expected Average Life : 2.74467 10⁸

Contact name : DsCo
Max Normal Load : 25.6555
Max Normal Stress : -243391.
Displacement : 0.000139243
Contact a-length : 0.0203546
Contact b-length : 0.00247523
Contact area : 0.000158281
Distance to Corner : 0.00440603
Effective Speed Factor : 2.659
Load-Life Factor : 8.2914

Expected Average Life : 1.79596 10⁷

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.9332
Residual Force Vector : {-0.0116846, -0.0768026, 0.00903583}

-7
Displacement Residual : 2.99999 10

Contact name : DpCi
Max Normal Load : 21.1925
Max Normal Stress : -228362.
Displacement : 0.000122559
Contact a-length : 0.0190963
Contact b-length : 0.00232196
Contact area : 0.000139301
Distance to Corner : 0.00566436
Effective Speed Factor : 2.659
Load-Life Factor : 10.0375

7
Expected Average Life : 3.85735 10

Contact name : DiCi
Max Normal Load : 12.9706
Max Normal Stress : -193520.
Displacement : 0.0000880175
Contact a-length : 0.0161831
Contact b-length : 0.0019678
Contact area : 0.000100044
Distance to Corner: Dp : 0.0100669
Distance to Corner: Ds : 0.0100669
Effective Speed Factor : 2.659
Load-Life Factor : 16.4002

8
Expected Average Life : 2.74904 10

Contact name : DsCo
Max Normal Load : 25.7179
Max Normal Stress : -243588.
Displacement : 0.000139469
Contact a-length : 0.0203711
Contact b-length : 0.00247723
Contact area : 0.000158537
Distance to Corner : 0.00438956
Effective Speed Factor : 2.659
Load-Life Factor : 8.27128

7
Expected Average Life : 1.77858 10

=====

Ball number : 27
Ball angle : 90.
Ball position : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.8311
Residual Force Vector : {0.00166613, -0.0781234, 0.00887676}

-7
Displacement Residual : 3.02589 10

Contact name : DpCi
Max Normal Load : 21.2686
Max Normal Stress : -228636.
Displacement : 0.000122853
Contact a-length : 0.0191192
Contact b-length : 0.00232474
Contact area : 0.000139635
Distance to Corner : 0.00564146
Effective Speed Factor : 2.659
Load-Life Factor : 10.0016

7
Expected Average Life : 3.80243 10

Contact name : DiCi
Max Normal Load : 12.9652
Max Normal Stress : -193491.
Displacement : 0.0000879907
Contact a-length : 0.0161806
Contact b-length : 0.0019675
Contact area : 0.000100014
Distance to Corner: Dp : 0.0100694
Distance to Corner: Ds : 0.0100694
Effective Speed Factor : 2.659
Load-Life Factor : 16.407

8
Expected Average Life : 2.75361 10

Contact name : DsCo
Max Normal Load : 25.78
Max Normal Stress : -243784.
Displacement : 0.000139693
Contact a-length : 0.0203875
Contact b-length : 0.00247922
Contact area : 0.000158792
Distance to Corner : 0.00437318
Effective Speed Factor : 2.659
Load-Life Factor : 8.25135

7
Expected Average Life : 1.7615 10

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.7294
Residual Force Vector : {0.0151273, -0.0771244, 0.00871974}

Displacement Residual : 3.05165 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.3444
Max Normal Stress : -228908.
Displacement : 0.000123145
Contact a-length : 0.019142
Contact b-length : 0.00232751
Contact area : 0.000139968
Distance to Corner : 0.00561871
Effective Speed Factor : 2.659
Load-Life Factor : 9.96607

Expected Average Life : 3.74869 10⁷

Contact name : DiCi
Max Normal Load : 12.9596
Max Normal Stress : -193460.
Displacement : 0.0000879629
Contact a-length : 0.0161781
Contact b-length : 0.00196719
Contact area : 0.0000999823
Distance to Corner: Dp : 0.0100719
Distance to Corner: Ds : 0.0100719
Effective Speed Factor : 2.659
Load-Life Factor : 16.4141

Expected Average Life : 2.75838 10⁸

Contact name : DsCo
Max Normal Load : 25.8418
Max Normal Stress : -243979.
Displacement : 0.000139916
Contact a-length : 0.0204038
Contact b-length : 0.0024812
Contact area : 0.000159046
Distance to Corner : 0.00435692
Effective Speed Factor : 2.659
Load-Life Factor : 8.23161

Expected Average Life : 1.74471 10⁷

```
=====
Ball number      : 29
Ball angle       : 70.
Ball position     : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 30.6281
Residual Force Vector : {0.0282959, -0.0738064, 0.00856473}
Displacement Residual : 3.07727 10-7
****
Contact name      : DpCi
Max Normal Load   : 21.42
Max Normal Stress : -229178.
Displacement      : 0.000123436
Contact a-length  : 0.0191646
Contact b-length  : 0.00233026
Contact area      : 0.000140298
Distance to Corner : 0.00559609
Effective Speed Factor : 2.659
Load-Life Factor  : 9.93092
Expected Average Life : 3.69608 107
****
Contact name      : DiCi
Max Normal Load   : 12.9537
Max Normal Stress : -193428.
Displacement      : 0.000087934
Contact a-length  : 0.0161754
Contact b-length  : 0.00196687
Contact area      : 0.0000999496
Distance to Corner: Dp : 0.0100746
Distance to Corner: Ds : 0.0100746
Effective Speed Factor : 2.659
Load-Life Factor  : 16.4215
Expected Average Life : 2.76335 108
****
Contact name      : DsCo
Max Normal Load   : 25.9034
Max Normal Stress : -244172.
Displacement      : 0.000140138
Contact a-length  : 0.0204199
Contact b-length  : 0.00248317
Contact area      : 0.000159298
Distance to Corner : 0.00434075
Effective Speed Factor : 2.659
Load-Life Factor  : 8.21206
Expected Average Life : 1.72819 107
```


=====

Ball number : 30
 Ball angle : 60.
 Ball position : {2.19968, 1.02573, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 30.5272
 Residual Force Vector : {0.0407723, -0.0682405, 0.00841171}

-7
 Displacement Residual : 3.10275 10

Contact name : DpCi
 Max Normal Load : 21.4952
 Max Normal Stress : -229447.
 Displacement : 0.000123726
 Contact a-length : 0.0191871
 Contact b-length : 0.00233299
 Contact area : 0.000140628
 Distance to Corner : 0.00557361
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.89615

7
 Expected Average Life : 3.64459 10

Contact name : DiCi
 Max Normal Load : 12.9477
 Max Normal Stress : -193396.
 Displacement : 0.0000879042
 Contact a-length : 0.0161727
 Contact b-length : 0.00196653
 Contact area : 0.0000999157
 Distance to Corner: Dp : 0.0100773
 Distance to Corner: Ds : 0.0100773
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.4292

8
 Expected Average Life : 2.76852 10

Contact name : DsCo
 Max Normal Load : 25.9646
 Max Normal Stress : -244364.
 Displacement : 0.000140358
 Contact a-length : 0.020436
 Contact b-length : 0.00248512
 Contact area : 0.000159549
 Distance to Corner : 0.00432469
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.19269

7
 Expected Average Life : 1.71195 10

=====

Ball number : 31
 Ball angle : 50.
 Ball position : {1.99811, 1.39909, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 30.4268
 Residual Force Vector : {0.0521727, -0.0605664, 0.00826064}

Displacement Residual : 3.12809 10⁻⁷

Contact name : DpCi
 Max Normal Load : 21.5702
 Max Normal Stress : -229714.
 Displacement : 0.000124014
 Contact a-length : 0.0192094
 Contact b-length : 0.0023357
 Contact area : 0.000140955
 Distance to Corner : 0.00555127
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.86175

Expected Average Life : 3.59418 10⁷

Contact name : DiCi
 Max Normal Load : 12.9414
 Max Normal Stress : -193362.
 Displacement : 0.0000878734
 Contact a-length : 0.0161699
 Contact b-length : 0.00196619
 Contact area : 0.0000998806
 Distance to Corner: Dp : 0.0100801
 Distance to Corner: Ds : 0.0100801
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.4371

Expected Average Life : 2.77389 10⁸

Contact name : DsCo
 Max Normal Load : 26.0255
 Max Normal Stress : -244555.
 Displacement : 0.000140577
 Contact a-length : 0.0204519
 Contact b-length : 0.00248706
 Contact area : 0.000159798
 Distance to Corner : 0.00430873
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.17351

Expected Average Life : 1.69597 10⁷

```
=====
Ball number      : 32
Ball angle       : 40.
Ball position    : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 30.3268
Residual Force Vector : {0.0621409, -0.0509896, 0.00811149}
Displacement Residual : 3.15328 10-7
****
Contact name     : DpCi
Max Normal Load  : 21.6449
Max Normal Stress : -229980.
Displacement     : 0.000124301
Contact a-length : 0.0192316
Contact b-length : 0.0023384
Contact area     : 0.000141281
Distance to Corner : 0.00552907
Effective Speed Factor : 2.659
Load-Life Factor : 9.82772
Expected Average Life : 3.54482 107
****
Contact name     : DiCi
Max Normal Load  : 12.9349
Max Normal Stress : -193327.
Displacement     : 0.0000878416
Contact a-length : 0.0161669
Contact b-length : 0.00196583
Contact area     : 0.0000998445
Distance to Corner: Dp : 0.0100831
Distance to Corner: Ds : 0.0100831
Effective Speed Factor : 2.659
Load-Life Factor : 16.4454
Expected Average Life : 2.77946 108
****
Contact name     : DsCo
Max Normal Load  : 26.0862
Max Normal Stress : -244744.
Displacement     : 0.000140796
Contact a-length : 0.0204678
Contact b-length : 0.00248899
Contact area     : 0.000160046
Distance to Corner : 0.00429288
Effective Speed Factor : 2.659
Load-Life Factor : 8.15451
Expected Average Life : 1.68026 107
```

=====

Ball number : 33
Ball angle : 30.
Ball position : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.2272
Residual Force Vector : {0.0703598, -0.0397757, 0.00796423}

-7
Displacement Residual : 3.17833 10

Contact name : DpCi
Max Normal Load : 21.7193
Max Normal Stress : -230244.
Displacement : 0.000124587
Contact a-length : 0.0192537
Contact b-length : 0.00234109
Contact area : 0.000141606
Distance to Corner : 0.005507
Effective Speed Factor : 2.659
Load-Life Factor : 9.79405

7
Expected Average Life : 3.49649 10

Contact name : DiCi
Max Normal Load : 12.9282
Max Normal Stress : -193291.
Displacement : 0.0000878089
Contact a-length : 0.0161639
Contact b-length : 0.00196547
Contact area : 0.0000998073
Distance to Corner: Dp : 0.0100861
Distance to Corner: Ds : 0.0100861
Effective Speed Factor : 2.659
Load-Life Factor : 16.4539

8
Expected Average Life : 2.78522 10

Contact name : DsCo
Max Normal Load : 26.1465
Max Normal Stress : -244933.
Displacement : 0.000141012
Contact a-length : 0.0204836
Contact b-length : 0.00249091
Contact area : 0.000160292
Distance to Corner : 0.00427712
Effective Speed Factor : 2.659
Load-Life Factor : 8.13569

7
Expected Average Life : 1.6648 10

=====

Ball number : 34
Ball angle : 20.
Ball position : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.128
Residual Force Vector : {0.0765608, -0.027243, 0.00781883}

-7
Displacement Residual : 3.20323 10

Contact name : DpCi
Max Normal Load : 21.7934
Max Normal Stress : -230506.
Displacement : 0.000124871
Contact a-length : 0.0192756
Contact b-length : 0.00234375
Contact area : 0.000141929
Distance to Corner : 0.00548507
Effective Speed Factor : 2.659
Load-Life Factor : 9.76074

7
Expected Average Life : 3.44916 10

Contact name : DiCi
Max Normal Load : 12.9213
Max Normal Stress : -193254.
Displacement : 0.0000877752
Contact a-length : 0.0161608
Contact b-length : 0.00196509
Contact area : 0.000099769
Distance to Corner: Dp : 0.0100892
Distance to Corner: Ds : 0.0100892
Effective Speed Factor : 2.659
Load-Life Factor : 16.4627

8
Expected Average Life : 2.79118 10

Contact name : DsCo
Max Normal Load : 26.2066
Max Normal Stress : -245120.
Displacement : 0.000141228
Contact a-length : 0.0204992
Contact b-length : 0.00249281
Contact area : 0.000160537
Distance to Corner : 0.00426147
Effective Speed Factor : 2.659
Load-Life Factor : 8.11705

7
Expected Average Life : 1.64959 10

=====

Ball number : 35
Ball angle : 10.
Ball position : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.0293
Residual Force Vector : {0.0805337, -0.0137539, 0.00767527}

Displacement Residual : 3.22798 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.8673
Max Normal Stress : -230767.
Displacement : 0.000125153
Contact a-length : 0.0192974
Contact b-length : 0.0023464
Contact area : 0.00014225
Distance to Corner : 0.00546327
Effective Speed Factor : 2.659
Load-Life Factor : 9.72778

Expected Average Life : 3.40281 10⁷

Contact name : DiCi
Max Normal Load : 12.9142
Max Normal Stress : -193215.
Displacement : 0.0000877406
Contact a-length : 0.0161576
Contact b-length : 0.0019647
Contact area : 0.0000997297
Distance to Corner: Dp : 0.0100924
Distance to Corner: Ds : 0.0100924
Effective Speed Factor : 2.659
Load-Life Factor : 16.4718

Expected Average Life : 2.79734 10⁸

Contact name : DsCo
Max Normal Load : 26.2663
Max Normal Stress : -245306.
Displacement : 0.000141442
Contact a-length : 0.0205148
Contact b-length : 0.0024947
Contact area : 0.000160781
Distance to Corner : 0.00424591
Effective Speed Factor : 2.659
Load-Life Factor : 8.09858

Expected Average Life : 1.63463 10⁷

```
=====
Ball number      : 36
Ball angle       : 0.
Ball position    : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.1407
Residual Force Vector : {0.557705, 0.199261, -0.143309}
Displacement Residual : 2.43194 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.9461
Max Normal Stress : -224878.
Displacement     : 0.000118859
Contact a-length : 0.0188058
Contact b-length : 0.00228679
Contact area     : 0.000135104
Distance to Corner : 0.00595484
Effective Speed Factor : 2.659
Load-Life Factor : 10.6647
Expected Average Life : 4.91565 107
****
Contact name     : DiCi
Max Normal Load  : 14.974
Max Normal Stress : -201066.
Displacement     : 0.0000950156
Contact a-length : 0.0168142
Contact b-length : 0.00204453
Contact area     : 0.000107999
Distance to Corner: Dp : 0.00943585
Distance to Corner: Ds : 0.00943585
Effective Speed Factor : 2.659
Load-Life Factor : 14.206
Expected Average Life : 1.54762 108
****
Contact name     : DsCi
Max Normal Load  : 24.2275
Max Normal Stress : -238991.
Displacement     : 0.000134225
Contact a-length : 0.0199846
Contact b-length : 0.00242986
Contact area     : 0.000152555
Distance to Corner : 0.00477609
Effective Speed Factor : 2.659
Load-Life Factor : 8.78009
Expected Average Life : 2.25829 107
```

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.395194

Total Internal Loads (Fx,Fy,Fz)
 Primary Disk : {-330.919, 60.102, -505.545}
 Intermediate Disk : {12.0743, -23.0543, -23.7645}
 Secondary Disk : {319.988, -41.609, 531.859}

Total Axial Torque (Tz)
 Primary Disk : 31.7733
 Intermediate Disk : 1190.9
 Secondary Disk : -1200.

Torque Ratio: Ds/Dp : 37.7675
 Torque Ratio: Di/Dp : 37.4811
 Torque Ratio: Di/Ds : 0.992416

Torsional Stiffness (T/rad) : 173977.

Average Residual Force : {-0.0317412, 0.126704, -0.0708137}
 -6

Average Displacement Residual : 1.21371 10

Dp Speed : 10.
 Ds Speed : 0.27027
 Speed Conversion Ratio : 37.
 Effective N.D. Speed : 20.
 Minimum Expected Average Life

hours : 3.40281 10
 years : 3884.49

Average Load-Life Factor: Dp : 10.5036
 Average Load-Life Factor: Di : 15.3547
 Average Load-Life Factor: Ds : 8.6056

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	:	-230767.
At ball number	:	35
Maximum Compressive Contact Stress Di	:	-201066.
At ball number	:	36
Maximum Compressive Contact Stress Ds	:	-238991.
At ball number	:	36
Maximum Ball Deflection Dp	:	0.000125153
At ball number	:	35
Maximum Ball Deflection Di	:	0.0000950156
At ball number	:	36
Maximum Ball Deflection Ds	:	0.000141442
At ball number	:	35
Maximum Ball Contact Area Dp	:	0.00014225
At ball number	:	35
Maximum Ball Contact Area Di	:	0.000107999
At ball number	:	36
Maximum Ball Contact Area Ds	:	0.000160781
At ball number	:	35
Maximum Ball a-patch Dp	:	0.0192974
At ball number	:	35
Maximum Ball a-patch Di	:	0.0168142
At ball number	:	36
Maximum Ball a-patch Ds	:	0.0205148
At ball number	:	35
Maximum Ball b-patch Dp	:	0.0023464
At ball number	:	35
Maximum Ball b-patch Di	:	0.00204453
At ball number	:	36
Maximum Ball b-patch Ds	:	0.0024947
At ball number	:	35
Minimum Distance to Dp Corner	:	0.00546327
At ball number	:	35
Minimum Distance to Di Corner: Dp	:	0.00943585
At ball number	:	36
Minimum Distance to Di Corner: Ds	:	0.00943585
At ball number	:	36
Minimum Distance to Ds Corner	:	0.00424591
At ball number	:	35

=====
=====

Appendix-C: Numerical Results Detailed Report

Numerical Results Detailed Report

A detailed numerical study is presented in this appendix for several variations of the SYNKdrive design. The flank angle variations involve equal flank angles on both the primary and secondary disks. The conformity variations involve the primary, secondary and intermediate disks. This study was used as the source of numerical data for the design curve plots presented in the SBIR final report. This numerical study total twenty-eight (28) separate detailed calculations for the SBIR application of the SYNKdrive to the rotary table design. The numerical study was divided into the groups labeled A, B, C and D for the level of conformity including flat races, 51%, 52% and 53% conformity, respectively. For each group, the flank angles on the primary and secondary disks were varied in increments of five (5) degrees from twenty (25) degrees to fifty-five (55) degrees to generate the design curve profiles. Printed here are the detailed results of group C, 52% comformity. Details of the other results are available upon request.

A. Flat Race:

Case-1: Flank Angle: 25 degrees
Case-2: Flank Angle: 30 degrees
Case-3: Flank Angle: 35 degrees
Case-4: Flank Angle: 40 degrees
Case-5: Flank Angle: 45 degrees
Case-6: Flank Angle: 50 degrees
Case-7: Flank Angle: 55 degrees

B. Race Conformity: 51%

Case-1: Flank Angle: 25 degrees
Case-2: Flank Angle: 30 degrees
Case-3: Flank Angle: 35 degrees
Case-4: Flank Angle: 40 degrees
Case-5: Flank Angle: 45 degrees
Case-6: Flank Angle: 50 degrees
Case-7: Flank Angle: 55 degrees

C. Race Conformity: 52%

Case-1: Flank Angle: 25 degrees

Case-2: Flank Angle: 30 degrees

Case-3: Flank Angle: 35 degrees

Case-4: Flank Angle: 40 degrees

Case-5: Flank Angle: 45 degrees

Case-6: Flank Angle: 50 degrees

Case-7: Flank Angle: 55 degrees

D. Race Conformity: 53%

Case-1: Flank Angle: 25 degrees

Case-2: Flank Angle: 30 degrees

Case-3: Flank Angle: 35 degrees

Case-4: Flank Angle: 40 degrees

Case-5: Flank Angle: 45 degrees

Case-6: Flank Angle: 50 degrees

Case-7: Flank Angle: 55 degrees

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 25 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter = 0.15625

ConformingDiameter = 0.1625

ConformingPercentage = 52.

PrimaryFlankAngleDegrees = 25.

IntermediateFlankAngleDegrees = 0.

SecondaryFlankAngleDegrees = 25.

PrimaryFractionBallDepth = 0.3

SecondaryFractionBallDepth = 0.3

ToleranceFraction = 0.01

ContactToCornerDistance for Dp = 0.00194973

ContactToCornerDistance for Ds = 0.00194973

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

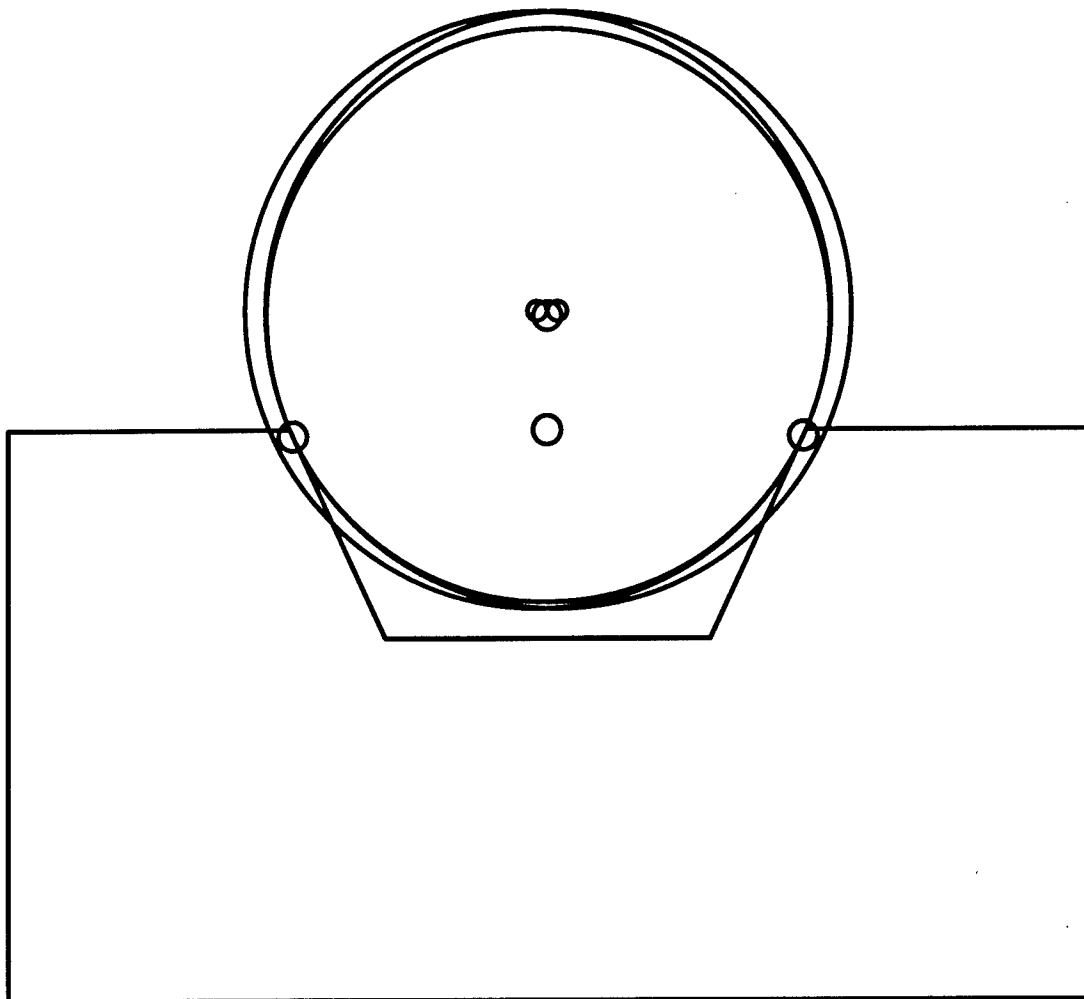
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ **2.0 Ball Race Section Profile**

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots        = 36 (requested balls)

BallConjugateDirection        = forward drive
BallConstraintCondition        = exactly constrained

Conjugate constraints          = 36
Forward drive condition        = 36
Reverser drive condition      = 38
Predicted speed ratio          = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart             = 0.
PrimaryAngleFinish             = 5.
PrimaryAngleDelta              = 1.
PrimaryAngleNumber             = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

===== Summary of Stress and Displacement Calculations =====

```

Calculated for kinematic solution : 6
Angular Deformation                 : 0.319435
Applied Torque                      : 1199.6

```


=====

Ball number : 1
Ball angle : 350.
Ball position : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 44.3861
Residual Force Vector : {-0.0130935, 0.476324, -0.245859}
Displacement Residual : 1.80386 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.0374
Max Normal Stress : -205369.
Displacement : 0.0000991304
Contact a-length : 0.0171744
Contact b-length : 0.00208841
Contact area : 0.00011268
Distance to Corner : -0.0152246
Effective Speed Factor : 2.659
Load-Life Factor : 14.1461

Expected Average Life : 1.52169 10⁸

Contact name : DiCi
Max Normal Load : 14.3581
Max Normal Stress : -199715.
Displacement : 0.0000937432
Contact a-length : 0.0167012
Contact b-length : 0.0020308
Contact area : 0.000106552
Distance to Corner: Dp : 0.00954881
Distance to Corner: Ds : 0.00954881
Effective Speed Factor : 2.659
Load-Life Factor : 14.8153

Expected Average Life : 1.83076 10⁸

Contact name : DsCi
Max Normal Load : 20.5531
Max Normal Stress : -225302.
Displacement : 0.000119289
Contact a-length : 0.0188399
Contact b-length : 0.00229068
Contact area : 0.000135579
Distance to Corner : -0.0168901
Effective Speed Factor : 2.659
Load-Life Factor : 10.3498

Expected Average Life : 4.3602 10⁷

```
=====
Ball number      : 2
Ball angle       : 340.
Ball position    : {-0.640757, 2.39134, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 44.5038
Residual Force Vector : {-0.106875, 0.457467, -0.244139}
Displacement Residual : 1.76127 10-6
****
Contact name     : DpCo
Max Normal Load  : 14.9706
Max Normal Stress : -205041.
Displacement     : 0.0000988144
Contact a-length : 0.017147
Contact b-length : 0.00208507
Contact area     : 0.00011232
Distance to Corner : -0.0151972
Effective Speed Factor : 2.659
Load-Life Factor : 14.2092
Expected Average Life : 1.54904 108
****
Contact name     : DiCi
Max Normal Load  : 14.334
Max Normal Stress : -199655.
Displacement     : 0.0000936869
Contact a-length : 0.0166962
Contact b-length : 0.00203019
Contact area     : 0.000106489
Distance to Corner: Dp : 0.00955382
Distance to Corner: Ds : 0.00955382
Effective Speed Factor : 2.659
Load-Life Factor : 14.8403
Expected Average Life : 1.8431 108
****
Contact name     : DsCi
Max Normal Load  : 20.4955
Max Normal Stress : -225080.
Displacement     : 0.000119053
Contact a-length : 0.0188213
Contact b-length : 0.00228842
Contact area     : 0.000135311
Distance to Corner : -0.0168716
Effective Speed Factor : 2.659
Load-Life Factor : 10.3789
Expected Average Life : 4.40942 107
```

```

=====
Ball number      : 3
Ball angle       : 330.
Ball position    : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 44.622
Residual Force Vector : {-0.194035, 0.420697, -0.242343}
Displacement Residual : 1.71893 10-6
****
Contact name     : DpCo
Max Normal Load  : 14.9036
Max Normal Stress : -204711.
Displacement     : 0.0000984967
Contact a-length : 0.0171194
Contact b-length : 0.00208172
Contact area     : 0.000111959
Distance to Corner : -0.0151697
Effective Speed Factor : 2.659
Load-Life Factor : 14.273
Expected Average Life : 1.57707 108
****
Contact name     : DiCi
Max Normal Load  : 14.3096
Max Normal Stress : -199594.
Displacement     : 0.0000936293
Contact a-length : 0.016691
Contact b-length : 0.00202956
Contact area     : 0.000106423
Distance to Corner: Dp : 0.00955896
Distance to Corner: Ds : 0.00955896
Effective Speed Factor : 2.659
Load-Life Factor : 14.8655
Expected Average Life : 1.8557 108
****
Contact name     : DsCi
Max Normal Load  : 20.4376
Max Normal Stress : -224856.
Displacement     : 0.000118817
Contact a-length : 0.0188026
Contact b-length : 0.00228614
Contact area     : 0.000135043
Distance to Corner : -0.0168529
Effective Speed Factor : 2.659
Load-Life Factor : 10.4083
Expected Average Life : 4.45965 107

```

```
=====
Ball number      : 4
Ball angle       : 320.
Ball position    : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 44.7408
Residual Force Vector : {-0.271242, 0.367824, -0.240468}
Displacement Residual : 1.67687 10-6
****
Contact name     : DpCo
Max Normal Load  : 14.8365
Max Normal Stress : -204379.
Displacement     : 0.0000981775
Contact a-length : 0.0170916
Contact b-length : 0.00207834
Contact area     : 0.000111596
Distance to Corner : -0.0151419
Effective Speed Factor : 2.659
Load-Life Factor : 14.3376
Expected Average Life : 1.60579 108
****
Contact name     : DiCi
Max Normal Load  : 14.2849
Max Normal Stress : -199531.
Displacement     : 0.0000935702
Contact a-length : 0.0166858
Contact b-length : 0.00202892
Contact area     : 0.000106356
Distance to Corner: Dp : 0.00956422
Distance to Corner: Ds : 0.00956422
Effective Speed Factor : 2.659
Load-Life Factor : 14.8912
Expected Average Life : 1.86855 108
****
Contact name     : DsCi
Max Normal Load  : 20.3792
Max Normal Stress : -224631.
Displacement     : 0.000118579
Contact a-length : 0.0187837
Contact b-length : 0.00228385
Contact area     : 0.000134772
Distance to Corner : -0.016834
Effective Speed Factor : 2.659
Load-Life Factor : 10.4381
Expected Average Life : 4.51092 107
```

=====

Ball number : 5
Ball angle : 310.
Ball position : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 44.86
Residual Force Vector : {-0.335607, 0.30126, -0.238516}

-6
Displacement Residual : 1.63512 10

Contact name : DpCo
Max Normal Load : 14.7693
Max Normal Stress : -204045.
Displacement : 0.0000978568
Contact a-length : 0.0170637
Contact b-length : 0.00207494
Contact area : 0.000111232
Distance to Corner : -0.015114
Effective Speed Factor : 2.659
Load-Life Factor : 14.4028

8
Expected Average Life : 1.63522 10

Contact name : DiCi
Max Normal Load : 14.26
Max Normal Stress : -199467.
Displacement : 0.0000935098
Contact a-length : 0.0166804
Contact b-length : 0.00202827
Contact area : 0.000106287
Distance to Corner: Dp : 0.00956961
Distance to Corner: Ds : 0.00956961
Effective Speed Factor : 2.659
Load-Life Factor : 14.9173

8
Expected Average Life : 1.88167 10

Contact name : DsCi
Max Normal Load : 20.3206
Max Normal Stress : -224404.
Displacement : 0.00011834
Contact a-length : 0.0187648
Contact b-length : 0.00228155
Contact area : 0.0001345
Distance to Corner : -0.0168151
Effective Speed Factor : 2.659
Load-Life Factor : 10.4682

7
Expected Average Life : 4.56326 10

=====

Ball number : 6
Ball angle : 300.
Ball position : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 44.9798
Residual Force Vector : {-0.384789, 0.223922, -0.236483}
Displacement Residual : 1.59372 10⁻⁶

Contact name : DpCo
Max Normal Load : 14.7019
Max Normal Stress : -203709.
Displacement : 0.0000975345
Contact a-length : 0.0170356
Contact b-length : 0.00207152
Contact area : 0.000110865
Distance to Corner : -0.0150858
Effective Speed Factor : 2.659
Load-Life Factor : 14.4688

Expected Average Life : 1.6654 10⁸

Contact name : DiCi
Max Normal Load : 14.2347
Max Normal Stress : -199401.
Displacement : 0.0000934479
Contact a-length : 0.0166749
Contact b-length : 0.0020276
Contact area : 0.000106217
Distance to Corner: Dp : 0.00957513
Distance to Corner: Ds : 0.00957513
Effective Speed Factor : 2.659
Load-Life Factor : 14.9437

Expected Average Life : 1.89505 10⁸

Contact name : DsCi
Max Normal Load : 20.2615
Max Normal Stress : -224175.
Displacement : 0.000118099
Contact a-length : 0.0187457
Contact b-length : 0.00227922
Contact area : 0.000134227
Distance to Corner : -0.016796
Effective Speed Factor : 2.659
Load-Life Factor : 10.4987

Expected Average Life : 4.61669 10⁷

=====

Ball number : 7
Ball angle : 290.
Ball position : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.1001
Residual Force Vector : {-0.417078, 0.139109, -0.234371}

-6
Displacement Residual : 1.55272 10

Contact name : DpCo
Max Normal Load : 14.6345
Max Normal Stress : -203371.
Displacement : 0.0000972106
Contact a-length : 0.0170073
Contact b-length : 0.00206808
Contact area : 0.000110497
Distance to Corner : -0.0150575
Effective Speed Factor : 2.659
Load-Life Factor : 14.5355

8
Expected Average Life : 1.69633 10

Contact name : DiCi
Max Normal Load : 14.2092
Max Normal Stress : -199333.
Displacement : 0.0000933846
Contact a-length : 0.0166692
Contact b-length : 0.00202691
Contact area : 0.000106145
Distance to Corner: Dp : 0.00958078
Distance to Corner: Ds : 0.00958078
Effective Speed Factor : 2.659
Load-Life Factor : 14.9706

8
Expected Average Life : 1.90871 10

Contact name : DsCi
Max Normal Load : 20.2021
Max Normal Stress : -223946.
Displacement : 0.000117857
Contact a-length : 0.0187265
Contact b-length : 0.00227689
Contact area : 0.000133951
Distance to Corner : -0.0167767
Effective Speed Factor : 2.659
Load-Life Factor : 10.5296

7
Expected Average Life : 4.67124 10

=====

Ball number : 8
Ball angle : 280.
Ball position : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.2209
Residual Force Vector : {-0.431461, 0.0503737, -0.232177}

Displacement Residual : 1.51215 10⁻⁶

Contact name : DpCo
Max Normal Load : 14.5669
Max Normal Stress : -203030.
Displacement : 0.0000968852
Contact a-length : 0.0169788
Contact b-length : 0.00206462
Contact area : 0.000110127
Distance to Corner : -0.015029
Effective Speed Factor : 2.659
Load-Life Factor : 14.603

Expected Average Life : 1.72804 10⁸

Contact name : DiCi
Max Normal Load : 14.1834
Max Normal Stress : -199264.
Displacement : 0.0000933199
Contact a-length : 0.0166634
Contact b-length : 0.00202621
Contact area : 0.000106071
Distance to Corner: Dp : 0.00958656
Distance to Corner: Ds : 0.00958656
Effective Speed Factor : 2.659
Load-Life Factor : 14.9979

Expected Average Life : 1.92265 10⁸

Contact name : DsCi
Max Normal Load : 20.1423
Max Normal Stress : -223714.
Displacement : 0.000117613
Contact a-length : 0.0187071
Contact b-length : 0.00227453
Contact area : 0.000133675
Distance to Corner : -0.0167574
Effective Speed Factor : 2.659
Load-Life Factor : 10.5609

Expected Average Life : 4.72695 10⁷


```
=====
Ball number      : 9
Ball angle       : 270.
Ball position    : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 45.3422
Residual Force Vector : {-0.427644, -0.0386243, -0.2299}
Displacement Residual : 1.47209 10-6
****
Contact name     : DpCo
Max Normal Load  : 14.4991
Max Normal Stress : -202687.
Displacement     : 0.0000965582
Contact a-length : 0.0169501
Contact b-length : 0.00206113
Contact area     : 0.000109756
Distance to Corner : -0.0150004
Effective Speed Factor : 2.659
Load-Life Factor : 14.6712
Expected Average Life : 1.76055 108
****
Contact name     : DiCi
Max Normal Load  : 14.1572
Max Normal Stress : -199193.
Displacement     : 0.0000932537
Contact a-length : 0.0166575
Contact b-length : 0.00202549
Contact area     : 0.000105996
Distance to Corner: Dp : 0.00959247
Distance to Corner: Ds : 0.00959247
Effective Speed Factor : 2.659
Load-Life Factor : 15.0255
Expected Average Life : 1.93689 108
****
Contact name     : DsCi
Max Normal Load  : 20.0821
Max Normal Stress : -223481.
Displacement     : 0.000117369
Contact a-length : 0.0186876
Contact b-length : 0.00227217
Contact area     : 0.000133396
Distance to Corner : -0.0167379
Effective Speed Factor : 2.659
Load-Life Factor : 10.5925
Expected Average Life : 4.78384 107
```

=====

Ball number : 10
Ball angle : 260.
Ball position : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.464
Residual Force Vector : {-0.406068, -0.124259, -0.227541}

-6
Displacement Residual : 1.43258 10

Contact name : DpCo
Max Normal Load : 14.4313
Max Normal Stress : -202342.
Displacement : 0.0000962297
Contact a-length : 0.0169212
Contact b-length : 0.00205762
Contact area : 0.000109382
Distance to Corner : -0.0149715
Effective Speed Factor : 2.659
Load-Life Factor : 14.7402

8
Expected Average Life : 1.79389 10

Contact name : DiCi
Max Normal Load : 14.1308
Max Normal Stress : -199121.
Displacement : 0.000093186
Contact a-length : 0.0166515
Contact b-length : 0.00202475
Contact area : 0.000105919
Distance to Corner: Dp : 0.00959852
Distance to Corner: Ds : 0.00959852
Effective Speed Factor : 2.659
Load-Life Factor : 15.0536

8
Expected Average Life : 1.95141 10

Contact name : DsCi
Max Normal Load : 20.0216
Max Normal Stress : -223246.
Displacement : 0.000117122
Contact a-length : 0.018668
Contact b-length : 0.00226978
Contact area : 0.000133116
Distance to Corner : -0.0167183
Effective Speed Factor : 2.659
Load-Life Factor : 10.6245

7
Expected Average Life : 4.84196 10

=====

Ball number : 11
Ball angle : 250.
Ball position : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.5863
Residual Force Vector : {-0.367875, -0.203081, -0.225096}

-6
Displacement Residual : 1.39369 10

Contact name : DpCo
Max Normal Load : 14.3633
Max Normal Stress : -201995.
Displacement : 0.0000958995
Contact a-length : 0.0168922
Contact b-length : 0.00205409
Contact area : 0.000109007
Distance to Corner : -0.0149424
Effective Speed Factor : 2.659
Load-Life Factor : 14.8099

8
Expected Average Life : 1.82809 10

Contact name : DiCi
Max Normal Load : 14.1041
Max Normal Stress : -199047.
Displacement : 0.0000931168
Contact a-length : 0.0166453
Contact b-length : 0.002024
Contact area : 0.00010584
Distance to Corner: Dp : 0.0096047
Distance to Corner: Ds : 0.0096047
Effective Speed Factor : 2.659
Load-Life Factor : 15.0822

8
Expected Average Life : 1.96625 10

Contact name : DsCi
Max Normal Load : 19.9607
Max Normal Stress : -223010.
Displacement : 0.000116874
Contact a-length : 0.0186483
Contact b-length : 0.00226738
Contact area : 0.000132835
Distance to Corner : -0.0166985
Effective Speed Factor : 2.659
Load-Life Factor : 10.6569

7
Expected Average Life : 4.90133 10

=====

Ball number : 12
Ball angle : 240.
Ball position : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.7092
Residual Force Vector : {-0.314864, -0.271953, -0.222567}

-6
Displacement Residual : 1.35549 10

Contact name : DpCo
Max Normal Load : 14.2952
Max Normal Stress : -201645.
Displacement : 0.0000955678
Contact a-length : 0.0168629
Contact b-length : 0.00205053
Contact area : 0.00010863
Distance to Corner : -0.0149132
Effective Speed Factor : 2.659
Load-Life Factor : 14.8805

8
Expected Average Life : 1.86317 10

Contact name : DiCi
Max Normal Load : 14.0771
Max Normal Stress : -198971.
Displacement : 0.000093046
Contact a-length : 0.016639
Contact b-length : 0.00202323
Contact area : 0.00010576
Distance to Corner: Dp : 0.00961103
Distance to Corner: Ds : 0.00961103
Effective Speed Factor : 2.659
Load-Life Factor : 15.1111

8
Expected Average Life : 1.98139 10

Contact name : DsCi
Max Normal Load : 19.8994
Max Normal Stress : -222772.
Displacement : 0.000116625
Contact a-length : 0.0186284
Contact b-length : 0.00226496
Contact area : 0.000132552
Distance to Corner : -0.0166786
Effective Speed Factor : 2.659
Load-Life Factor : 10.6898

7
Expected Average Life : 4.96199 10

=====

Ball number : 13
Ball angle : 230.
Ball position : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 45.8326
Residual Force Vector : {-0.24941, -0.328171, -0.219951}

-6

Displacement Residual : 1.31808 10

Contact name : DpCo
Max Normal Load : 14.227
Max Normal Stress : -201293.
Displacement : 0.0000952345
Contact a-length : 0.0168335
Contact b-length : 0.00204695
Contact area : 0.000108251
Distance to Corner : -0.0148838
Effective Speed Factor : 2.659
Load-Life Factor : 14.9518

8

Expected Average Life : 1.89915 10

Contact name : DiCi
Max Normal Load : 14.0497
Max Normal Stress : -198894.
Displacement : 0.0000929738
Contact a-length : 0.0166325
Contact b-length : 0.00202245
Contact area : 0.000105678
Distance to Corner: Dp : 0.00961749
Distance to Corner: Ds : 0.00961749
Effective Speed Factor : 2.659
Load-Life Factor : 15.1405

8

Expected Average Life : 1.99685 10

Contact name : DsCi
Max Normal Load : 19.8378
Max Normal Stress : -222533.
Displacement : 0.000116375
Contact a-length : 0.0186083
Contact b-length : 0.00226253
Contact area : 0.000132267
Distance to Corner : -0.0166586
Effective Speed Factor : 2.659
Load-Life Factor : 10.723

7

Expected Average Life : 5.02397 10

=====

Ball number : 14
 Ball angle : 220.
 Ball position : {-1.64746, -1.64746, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 45.9565
 Residual Force Vector : {-0.174368, -0.369567, -0.217248}

Displacement Residual : 1.28153 10⁻⁶

Contact name : DpCo
 Max Normal Load : 14.1587
 Max Normal Stress : -200939.
 Displacement : 0.0000948997
 Contact a-length : 0.0168039
 Contact b-length : 0.00204335
 Contact area : 0.00010787
 Distance to Corner : -0.0148542
 Effective Speed Factor : 2.659
 Load-Life Factor : 15.0239

Expected Average Life : 1.93606 10⁸

Contact name : DiCi
 Max Normal Load : 14.0221
 Max Normal Stress : -198815.
 Displacement : 0.0000929
 Contact a-length : 0.0166259
 Contact b-length : 0.00202164
 Contact area : 0.000105594
 Distance to Corner: Dp : 0.00962409
 Distance to Corner: Ds : 0.00962409
 Effective Speed Factor : 2.659
 Load-Life Factor : 15.1703

Expected Average Life : 2.01263 10⁸

Contact name : DsCi
 Max Normal Load : 19.7757
 Max Normal Stress : -222292.
 Displacement : 0.000116123
 Contact a-length : 0.0185882
 Contact b-length : 0.00226007
 Contact area : 0.00013198
 Distance to Corner : -0.0166385
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.7566

Expected Average Life : 5.08732 10⁷

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 46.0809
Residual Force Vector : {-0.0929543, -0.394592, -0.214456}
Displacement Residual : 1.24597 10⁻⁶

Contact name : DpCo
Max Normal Load : 14.0903
Max Normal Stress : -200582.
Displacement : 0.0000945632
Contact a-length : 0.0167741
Contact b-length : 0.00203972
Contact area : 0.000107488
Distance to Corner : -0.0148243
Effective Speed Factor : 2.659
Load-Life Factor : 15.0969

8

Expected Average Life : 1.97394 10

Contact name : DiCi
Max Normal Load : 13.9942
Max Normal Stress : -198734.
Displacement : 0.0000928247
Contact a-length : 0.0166192
Contact b-length : 0.00202082
Contact area : 0.000105508
Distance to Corner: Dp : 0.00963083
Distance to Corner: Ds : 0.00963083
Effective Speed Factor : 2.659
Load-Life Factor : 15.2006

8

Expected Average Life : 2.02875 10

Contact name : DsCi
Max Normal Load : 19.7133
Max Normal Stress : -222049.
Displacement : 0.000115869
Contact a-length : 0.0185679
Contact b-length : 0.00225761
Contact area : 0.000131692
Distance to Corner : -0.0166181
Effective Speed Factor : 2.659
Load-Life Factor : 10.7907

7

Expected Average Life : 5.15206 10

=====

Ball number : 16
Ball angle : 200.
Ball position : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 46.2058
Residual Force Vector : {-0.00861936, -0.402373, -0.211576}

-6
Displacement Residual : 1.21148 10

Contact name : DpCo
Max Normal Load : 14.0218
Max Normal Stress : -200224.
Displacement : 0.0000942252
Contact a-length : 0.0167441
Contact b-length : 0.00203608
Contact area : 0.000107104
Distance to Corner : -0.0147943
Effective Speed Factor : 2.659
Load-Life Factor : 15.1707

8
Expected Average Life : 2.01281 10

Contact name : DiCi
Max Normal Load : 13.9659
Max Normal Stress : -198652.
Displacement : 0.0000927477
Contact a-length : 0.0166123
Contact b-length : 0.00201998
Contact area : 0.000105421
Distance to Corner: Dp : 0.00963772
Distance to Corner: Ds : 0.00963772
Effective Speed Factor : 2.659
Load-Life Factor : 15.2314

8
Expected Average Life : 2.04521 10

Contact name : DsCi
Max Normal Load : 19.6505
Max Normal Stress : -221804.
Displacement : 0.000115614
Contact a-length : 0.0185474
Contact b-length : 0.00225512
Contact area : 0.000131402
Distance to Corner : -0.0165977
Effective Speed Factor : 2.659
Load-Life Factor : 10.8252

7
Expected Average Life : 5.21825 10

=====

Ball number : 17
Ball angle : 190.
Ball position : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 46.3313
Residual Force Vector : {0.0750935, -0.392745, -0.208605}

-6
Displacement Residual : 1.17821 10

Contact name : DpCo
Max Normal Load : 13.9532
Max Normal Stress : -199862.
Displacement : 0.0000938856
Contact a-length : 0.0167139
Contact b-length : 0.0020324
Contact area : 0.000106718
Distance to Corner : -0.0147641
Effective Speed Factor : 2.659
Load-Life Factor : 15.2453

8
Expected Average Life : 2.0527 10

Contact name : DiCi
Max Normal Load : 13.9374
Max Normal Stress : -198568.
Displacement : 0.0000926692
Contact a-length : 0.0166052
Contact b-length : 0.00201913
Contact area : 0.000105332
Distance to Corner: Dp : 0.00964475
Distance to Corner: Ds : 0.00964475
Effective Speed Factor : 2.659
Load-Life Factor : 15.2626

8
Expected Average Life : 2.06202 10

Contact name : DsCi
Max Normal Load : 19.5873
Max Normal Stress : -221558.
Displacement : 0.000115358
Contact a-length : 0.0185269
Contact b-length : 0.00225262
Contact area : 0.000131111
Distance to Corner : -0.0165771
Effective Speed Factor : 2.659
Load-Life Factor : 10.8601

7
Expected Average Life : 5.28593 10

=====

Ball number : 18
 Ball angle : 180.
 Ball position : {-0.198824, -2.27257, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.7833
 Residual Force Vector : {-0.710991, 0.804888, -0.383412}

-6
 Displacement Residual : 5.54924 10

Contact name : DpCi
 Max Normal Load : 14.7736
 Max Normal Stress : -206210.
 Displacement : 0.0000999349
 Contact a-length : 0.0172439
 Contact b-length : 0.00209672
 Contact area : 0.000113587
 Distance to Corner : -0.0152942
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.3987

8
 Expected Average Life : 1.63333 10

Contact name : DiCi
 Max Normal Load : 13.8314
 Max Normal Stress : -193913.
 Displacement : 0.0000883752
 Contact a-length : 0.016216
 Contact b-length : 0.00197179
 Contact area : 0.000100451
 Distance to Corner: Dp : 0.010034
 Distance to Corner: Ds : 0.010034
 Effective Speed Factor : 2.659
 Load-Life Factor : 15.3795

8
 Expected Average Life : 2.12593 10

Contact name : DsCo
 Max Normal Load : 21.3913
 Max Normal Stress : -228709.
 Displacement : 0.00012295
 Contact a-length : 0.0191268
 Contact b-length : 0.00232591
 Contact area : 0.000139761
 Distance to Corner : -0.0171771
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.94425

7
 Expected Average Life : 3.71596 10

=====

Ball number : 19
 Ball angle : 170.
 Ball position : {0.199883, -2.28468, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.6564
 Residual Force Vector : {-0.863285, 0.665837, -0.382318}

-6
 Displacement Residual : 5.62326 10

Contact name : DpCi
 Max Normal Load : 14.855
 Max Normal Stress : -206590.
 Displacement : 0.000100304
 Contact a-length : 0.0172757
 Contact b-length : 0.00210059
 Contact area : 0.000114006
 Distance to Corner : -0.015326
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.3198

8
 Expected Average Life : 1.59783 10

Contact name : DiCi
 Max Normal Load : 13.8582
 Max Normal Stress : -193953.
 Displacement : 0.0000884114
 Contact a-length : 0.0162193
 Contact b-length : 0.0019722
 Contact area : 0.000100492
 Distance to Corner: Dp : 0.0100307
 Distance to Corner: Ds : 0.0100307
 Effective Speed Factor : 2.659
 Load-Life Factor : 15.3498

8
 Expected Average Life : 2.10956 10

Contact name : DsCo
 Max Normal Load : 21.4573
 Max Normal Stress : -228970.
 Displacement : 0.000123231
 Contact a-length : 0.0191486
 Contact b-length : 0.00232857
 Contact area : 0.00014008
 Distance to Corner : -0.0171989
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.91363

7
 Expected Average Life : 3.6704 10

=====

Ball number : 20
 Ball angle : 160.
 Ball position : {0.596722, -2.227, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.53
 Residual Force Vector : {-0.988088, 0.498277, -0.381138}

-6
 Displacement Residual : 5.69686 10

Contact name : DpCi
 Max Normal Load : 14.9363
 Max Normal Stress : -206968.
 Displacement : 0.000100671
 Contact a-length : 0.0173073
 Contact b-length : 0.00210443
 Contact area : 0.000114423
 Distance to Corner : -0.0153576
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.2418

8
 Expected Average Life : 1.56332 10

Contact name : DiCi
 Max Normal Load : 13.8845
 Max Normal Stress : -193990.
 Displacement : 0.0000884459
 Contact a-length : 0.0162225
 Contact b-length : 0.00197258
 Contact area : 0.000100531
 Distance to Corner: Dp : 0.0100275
 Distance to Corner: Ds : 0.0100275
 Effective Speed Factor : 2.659
 Load-Life Factor : 15.3207

8
 Expected Average Life : 2.09362 10

Contact name : DsCo
 Max Normal Load : 21.523
 Max Normal Stress : -229229.
 Displacement : 0.00012351
 Contact a-length : 0.0191703
 Contact b-length : 0.0023312
 Contact area : 0.000140397
 Distance to Corner : -0.0172205
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.88338

7
 Expected Average Life : 3.62581 10

=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.4041
Residual Force Vector : {-1.08013, 0.307679, -0.379874}
Displacement Residual : 5.77004 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.0175
Max Normal Stress : -207343.
Displacement : 0.000101036
Contact a-length : 0.0173387
Contact b-length : 0.00210825
Contact area : 0.000114838
Distance to Corner : -0.015389
Effective Speed Factor : 2.659
Load-Life Factor : 14.1648

8

Expected Average Life : 1.52978 10

Contact name : DiCi
Max Normal Load : 13.9104
Max Normal Stress : -194026.
Displacement : 0.0000884787
Contact a-length : 0.0162255
Contact b-length : 0.00197295
Contact area : 0.000100569
Distance to Corner: Dp : 0.0100245
Distance to Corner: Ds : 0.0100245
Effective Speed Factor : 2.659
Load-Life Factor : 15.2922

8

Expected Average Life : 2.07807 10

Contact name : DsCo
Max Normal Load : 21.5883
Max Normal Stress : -229486.
Displacement : 0.000123787
Contact a-length : 0.0191918
Contact b-length : 0.00233382
Contact area : 0.000140712
Distance to Corner : -0.017242
Effective Speed Factor : 2.659
Load-Life Factor : 9.8535

7

Expected Average Life : 3.58216 10

=====

Ball number : 22
Ball angle : 140.
Ball position : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.2787
Residual Force Vector : {-1.13522, 0.100479, -0.378527}

-6

Displacement Residual : 5.84279 10

Contact name : DpCi
Max Normal Load : 15.0986
Max Normal Stress : -207716.
Displacement : 0.0001014
Contact a-length : 0.0173699
Contact b-length : 0.00211203
Contact area : 0.000115252
Distance to Corner : -0.0154201
Effective Speed Factor : 2.659
Load-Life Factor : 14.0888

8

Expected Average Life : 1.49718 10

Contact name : DiCi
Max Normal Load : 13.9358
Max Normal Stress : -194061.
Displacement : 0.0000885099
Contact a-length : 0.0162283
Contact b-length : 0.0019733
Contact area : 0.000100604
Distance to Corner: Dp : 0.0100217
Distance to Corner: Ds : 0.0100217
Effective Speed Factor : 2.659
Load-Life Factor : 15.2642

8

Expected Average Life : 2.06293 10

Contact name : DsCo
Max Normal Load : 21.6532
Max Normal Stress : -229741.
Displacement : 0.000124063
Contact a-length : 0.0192131
Contact b-length : 0.00233641
Contact area : 0.000141025
Distance to Corner : -0.0172634
Effective Speed Factor : 2.659
Load-Life Factor : 9.82397

7

Expected Average Life : 3.53942 10

=====

Ball number : 23
Ball angle : 130.
Ball position : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.1539
Residual Force Vector : {-1.15045, -0.116144, -0.377099}
-6
Displacement Residual : 5.91511 10

Contact name : DpCi
Max Normal Load : 15.1795
Max Normal Stress : -208086.
Displacement : 0.000101761
Contact a-length : 0.0174008
Contact b-length : 0.0021158
Contact area : 0.000115663
Distance to Corner : -0.0154511
Effective Speed Factor : 2.659
Load-Life Factor : 14.0136

8

Expected Average Life : 1.46549 10

Contact name : DiCi
Max Normal Load : 13.9609
Max Normal Stress : -194093.
Displacement : 0.0000885394
Contact a-length : 0.016231
Contact b-length : 0.00197363
Contact area : 0.000100638
Distance to Corner: Dp : 0.010019
Distance to Corner: Ds : 0.010019
Effective Speed Factor : 2.659
Load-Life Factor : 15.2369

8

Expected Average Life : 2.04817 10

Contact name : DsCo
Max Normal Load : 21.7176
Max Normal Stress : -229995.
Displacement : 0.000124337
Contact a-length : 0.0192343
Contact b-length : 0.00233899
Contact area : 0.000141337
Distance to Corner : -0.0172846
Effective Speed Factor : 2.659
Load-Life Factor : 9.79481

7

Expected Average Life : 3.49758 10

```

=====
Ball number      : 24
Ball angle       : 120.
Ball position    : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.0296
Residual Force Vector : {-1.12431, -0.334518, -0.375591}
                                     -6
Displacement Residual : 5.98702 10
****
Contact name      : DpCi
Max Normal Load   : 15.2604
Max Normal Stress : -208454.
Displacement      : 0.000102121
Contact a-length  : 0.0174316
Contact b-length  : 0.00211953
Contact area      : 0.000116072
Distance to Corner : -0.0154818
Effective Speed Factor : 2.659
Load-Life Factor  : 13.9393
                                     8
Expected Average Life : 1.43467 10
****
Contact name      : DiCi
Max Normal Load   : 13.9855
Max Normal Stress : -194124.
Displacement      : 0.0000885673
Contact a-length  : 0.0162336
Contact b-length  : 0.00197394
Contact area      : 0.000100669
Distance to Corner: Dp : 0.0100164
Distance to Corner: Ds : 0.0100164
Effective Speed Factor : 2.659
Load-Life Factor  : 15.21
                                     8
Expected Average Life : 2.03378 10
****
Contact name      : DsCo
Max Normal Load   : 21.7817
Max Normal Stress : -230246.
Displacement      : 0.000124609
Contact a-length  : 0.0192553
Contact b-length  : 0.00234155
Contact area      : 0.000141646
Distance to Corner : -0.0173056
Effective Speed Factor : 2.659
Load-Life Factor  : 9.76599
                                     7
Expected Average Life : 3.4566 10

```


=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.9059
Residual Force Vector : {-1.05674, -0.546743, -0.374005}

-6

Displacement Residual : 6.0585 10

Contact name : DpCi
Max Normal Load : 15.3412
Max Normal Stress : -208819.
Displacement : 0.000102479
Contact a-length : 0.0174621
Contact b-length : 0.00212325
Contact area : 0.000116479
Distance to Corner : -0.0155124
Effective Speed Factor : 2.659
Load-Life Factor : 13.866

8

Expected Average Life : 1.4047 10

Contact name : DiCi
Max Normal Load : 14.0097
Max Normal Stress : -194152.
Displacement : 0.0000885935
Contact a-length : 0.016236
Contact b-length : 0.00197423
Contact area : 0.000100699
Distance to Corner: Dp : 0.010014
Distance to Corner: Ds : 0.010014
Effective Speed Factor : 2.659
Load-Life Factor : 15.1838

8

Expected Average Life : 2.01977 10

Contact name : DsCo
Max Normal Load : 21.8454
Max Normal Stress : -230496.
Displacement : 0.000124879
Contact a-length : 0.0192762
Contact b-length : 0.00234409
Contact area : 0.000141953
Distance to Corner : -0.0173265
Effective Speed Factor : 2.659
Load-Life Factor : 9.73752

7

Expected Average Life : 3.41646 10

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.7826
Residual Force Vector : {-0.949216, -0.744982, -0.372343}

Displacement Residual : 6.12956 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.4218
Max Normal Stress : -209182.
Displacement : 0.000102836
Contact a-length : 0.0174924
Contact b-length : 0.00212693
Contact area : 0.000116884
Distance to Corner : -0.0155427
Effective Speed Factor : 2.659
Load-Life Factor : 13.7935

Expected Average Life : 1.37556 10⁸

Contact name : DiCi
Max Normal Load : 14.0335
Max Normal Stress : -194179.
Displacement : 0.0000886182
Contact a-length : 0.0162382
Contact b-length : 0.0019745
Contact area : 0.000100727
Distance to Corner: Dp : 0.0100118
Distance to Corner: Ds : 0.0100118
Effective Speed Factor : 2.659
Load-Life Factor : 15.158

Expected Average Life : 2.00612 10⁸

Contact name : DsCo
Max Normal Load : 21.9087
Max Normal Stress : -230744.
Displacement : 0.000125148
Contact a-length : 0.019297
Contact b-length : 0.00234661
Contact area : 0.000142259
Distance to Corner : -0.0173472
Effective Speed Factor : 2.659
Load-Life Factor : 9.70938

Expected Average Life : 3.37714 10⁷

=====

Ball number : 27
Ball angle : 90.
Ball position : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.6599
Residual Force Vector : {-0.804667, -0.921739, -0.370607}
Displacement Residual : 6.2002 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.5023
Max Normal Stress : -209542.
Displacement : 0.00010319
Contact a-length : 0.0175225
Contact b-length : 0.0021306
Contact area : 0.000117287
Distance to Corner : -0.0155728
Effective Speed Factor : 2.659
Load-Life Factor : 13.7219

8

Expected Average Life : 1.34721 10

Contact name : DiCi
Max Normal Load : 14.0568
Max Normal Stress : -194205.
Displacement : 0.0000886412
Contact a-length : 0.0162404
Contact b-length : 0.00197476
Contact area : 0.000100753
Distance to Corner: Dp : 0.0100096
Distance to Corner: Ds : 0.0100096
Effective Speed Factor : 2.659
Load-Life Factor : 15.1328

8

Expected Average Life : 1.99281 10

Contact name : DsCo
Max Normal Load : 21.9716
Max Normal Stress : -230990.
Displacement : 0.000125415
Contact a-length : 0.0193176
Contact b-length : 0.00234911
Contact area : 0.000142563
Distance to Corner : -0.0173678
Effective Speed Factor : 2.659
Load-Life Factor : 9.68158

7

Expected Average Life : 3.33863 10

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.5377
Residual Force Vector : {-0.627431, -1.07014, -0.368797}

Displacement Residual : 6.27043 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.5826
Max Normal Stress : -209900.
Displacement : 0.000103543
Contact a-length : 0.0175525
Contact b-length : 0.00213423
Contact area : 0.000117687
Distance to Corner : -0.0156027
Effective Speed Factor : 2.659
Load-Life Factor : 13.6511

Expected Average Life : 1.31963 10⁸

Contact name : DiCi
Max Normal Load : 14.0798
Max Normal Stress : -194228.
Displacement : 0.0000886627
Contact a-length : 0.0162423
Contact b-length : 0.001975
Contact area : 0.000100778
Distance to Corner: Dp : 0.0100077
Distance to Corner: Ds : 0.0100077
Effective Speed Factor : 2.659
Load-Life Factor : 15.1082

Expected Average Life : 1.97985 10⁸

Contact name : DsCo
Max Normal Load : 22.0342
Max Normal Stress : -231235.
Displacement : 0.000125681
Contact a-length : 0.019338
Contact b-length : 0.0023516
Contact area : 0.000142865
Distance to Corner : -0.0173883
Effective Speed Factor : 2.659
Load-Life Factor : 9.6541

Expected Average Life : 3.30088 10⁷

=====

Ball number : 29
Ball angle : 70.
Ball position : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.4161
Residual Force Vector : {-0.423113, -1.1842, -0.366916}

-6
Displacement Residual : 6.34024 10

Contact name : DpCi
Max Normal Load : 15.6629
Max Normal Stress : -210255.
Displacement : 0.000103894
Contact a-length : 0.0175822
Contact b-length : 0.00213785
Contact area : 0.000118086
Distance to Corner : -0.0156325
Effective Speed Factor : 2.659
Load-Life Factor : 13.5812

8
Expected Average Life : 1.2928 10

Contact name : DiCi
Max Normal Load : 14.1023
Max Normal Stress : -194250.
Displacement : 0.0000886827
Contact a-length : 0.0162442
Contact b-length : 0.00197522
Contact area : 0.000100801
Distance to Corner: Dp : 0.0100058
Distance to Corner: Ds : 0.0100058
Effective Speed Factor : 2.659
Load-Life Factor : 15.084

8
Expected Average Life : 1.96722 10

Contact name : DsCo
Max Normal Load : 22.0963
Max Normal Stress : -231477.
Displacement : 0.000125945
Contact a-length : 0.0193583
Contact b-length : 0.00235407
Contact area : 0.000143165
Distance to Corner : -0.0174086
Effective Speed Factor : 2.659
Load-Life Factor : 9.62694

7
Expected Average Life : 3.2639 10

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.2949
Residual Force Vector : {-0.198402, -1.25903, -0.364966}

-6
Displacement Residual : 6.40963 10

Contact name : DpCi
Max Normal Load : 15.743
Max Normal Stress : -210608.
Displacement : 0.000104243
Contact a-length : 0.0176117
Contact b-length : 0.00214144
Contact area : 0.000118483
Distance to Corner : -0.015662
Effective Speed Factor : 2.659
Load-Life Factor : 13.5121

8
Expected Average Life : 1.26669 10

Contact name : DiCi
Max Normal Load : 14.1245
Max Normal Stress : -194270.
Displacement : 0.0000887011
Contact a-length : 0.0162458
Contact b-length : 0.00197543
Contact area : 0.000100821
Distance to Corner: Dp : 0.0100042
Distance to Corner: Ds : 0.0100042
Effective Speed Factor : 2.659
Load-Life Factor : 15.0604

8
Expected Average Life : 1.95492 10

Contact name : DsCo
Max Normal Load : 22.1581
Max Normal Stress : -231718.
Displacement : 0.000126207
Contact a-length : 0.0193784
Contact b-length : 0.00235652
Contact area : 0.000143463
Distance to Corner : -0.0174287
Effective Speed Factor : 2.659
Load-Life Factor : 9.6001

7
Expected Average Life : 3.22765 10

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.1743
Residual Force Vector : {0.0391436, -1.29105, -0.362947}
Displacement Residual : 6.47861 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.8229
Max Normal Stress : -210959.
Displacement : 0.00010459
Contact a-length : 0.017641
Contact b-length : 0.002145
Contact area : 0.000118878
Distance to Corner : -0.0156913
Effective Speed Factor : 2.659
Load-Life Factor : 13.4438

Expected Average Life : 1.24128 10⁸

Contact name : DiCi
Max Normal Load : 14.1462
Max Normal Stress : -194289.
Displacement : 0.000088718
Contact a-length : 0.0162474
Contact b-length : 0.00197562
Contact area : 0.000100841
Distance to Corner: Dp : 0.0100026
Distance to Corner: Ds : 0.0100026
Effective Speed Factor : 2.659
Load-Life Factor : 15.0373

Expected Average Life : 1.94294 10⁸

Contact name : DsCo
Max Normal Load : 22.2195
Max Normal Stress : -231957.
Displacement : 0.000126468
Contact a-length : 0.0193984
Contact b-length : 0.00235895
Contact area : 0.000143759
Distance to Corner : -0.0174487
Effective Speed Factor : 2.659
Load-Life Factor : 9.57357

Expected Average Life : 3.19212 10⁷

=====

Ball number : 32
Ball angle : 40.
Ball position : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.0542
Residual Force Vector : {0.281356, -1.27816, -0.360862}
Displacement Residual : 6.54717 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.9027
Max Normal Stress : -211307.
Displacement : 0.000104936
Contact a-length : 0.0176701
Contact b-length : 0.00214854
Contact area : 0.000119271
Distance to Corner : -0.0157204
Effective Speed Factor : 2.659
Load-Life Factor : 13.3763

8

Expected Average Life : 1.21655 10

Contact name : DiCi
Max Normal Load : 14.1675
Max Normal Stress : -194306.
Displacement : 0.0000887334
Contact a-length : 0.0162488
Contact b-length : 0.00197579
Contact area : 0.000100858
Distance to Corner: Dp : 0.0100012
Distance to Corner: Ds : 0.0100012
Effective Speed Factor : 2.659
Load-Life Factor : 15.0146

8

Expected Average Life : 1.93127 10

Contact name : DsCo
Max Normal Load : 22.2805
Max Normal Stress : -232195.
Displacement : 0.000126727
Contact a-length : 0.0194183
Contact b-length : 0.00236137
Contact area : 0.000144054
Distance to Corner : -0.0174686
Effective Speed Factor : 2.659
Load-Life Factor : 9.54734

7

Expected Average Life : 3.15729 10


```
=====
Ball number      : 33
Ball angle       : 30.
Ball position    : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 35.9346
Residual Force Vector : {0.519737, -1.21979, -0.358712}
Displacement Residual : 6.61532 10-6
****
Contact name     : DpCi
Max Normal Load  : 15.9824
Max Normal Stress : -211653.
Displacement     : 0.00010528
Contact a-length : 0.0176991
Contact b-length : 0.00215206
Contact area     : 0.000119661
Distance to Corner : -0.0157493
Effective Speed Factor : 2.659
Load-Life Factor : 13.3096
Expected Average Life : 1.19247 108
****
Contact name     : DiCi
Max Normal Load  : 14.1884
Max Normal Stress : -194321.
Displacement     : 0.0000887474
Contact a-length : 0.0162501
Contact b-length : 0.00197594
Contact area     : 0.000100874
Distance to Corner: Dp : 0.00999993
Distance to Corner: Ds : 0.00999993
Effective Speed Factor : 2.659
Load-Life Factor : 14.9925
Expected Average Life : 1.9199 108
****
Contact name     : DsCo
Max Normal Load  : 22.3412
Max Normal Stress : -232431.
Displacement     : 0.000126984
Contact a-length : 0.019438
Contact b-length : 0.00236376
Contact area     : 0.000144346
Distance to Corner : -0.0174883
Effective Speed Factor : 2.659
Load-Life Factor : 9.52142
Expected Average Life : 3.12313 107
```

=====

Ball number : 34
Ball angle : 20.
Ball position : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.8155
Residual Force Vector : {0.745756, -1.117, -0.356499}
Displacement Residual : 6.68306 10⁻⁶

Contact name : DpCi
Max Normal Load : 16.0619
Max Normal Stress : -211997.
Displacement : 0.000105622
Contact a-length : 0.0177278
Contact b-length : 0.00215555
Contact area : 0.00012005
Distance to Corner : -0.0157781
Effective Speed Factor : 2.659
Load-Life Factor : 13.2437

8

Expected Average Life : 1.16903 10

Contact name : DiCi
Max Normal Load : 14.209
Max Normal Stress : -194334.
Displacement : 0.0000887599
Contact a-length : 0.0162512
Contact b-length : 0.00197608
Contact area : 0.000100888
Distance to Corner: Dp : 0.00999878
Distance to Corner: Ds : 0.00999878
Effective Speed Factor : 2.659
Load-Life Factor : 14.9708

8

Expected Average Life : 1.90884 10

Contact name : DsCo
Max Normal Load : 22.4015
Max Normal Stress : -232665.
Displacement : 0.00012724
Contact a-length : 0.0194576
Contact b-length : 0.00236614
Contact area : 0.000144637
Distance to Corner : -0.0175079
Effective Speed Factor : 2.659
Load-Life Factor : 9.49579

7

Expected Average Life : 3.08965 10

```

=====
Ball number      : 35
Ball angle       : 10.
Ball position    : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 35.697
Residual Force Vector : {0.95115, -0.972423, -0.354223}
Displacement Residual : 6.7504 10-6
****
Contact name     : DpCi
Max Normal Load  : 16.1413
Max Normal Stress : -212338.
Displacement     : 0.000105962
Contact a-length : 0.0177563
Contact b-length : 0.00215902
Contact area     : 0.000120437
Distance to Corner : -0.0158066
Effective Speed Factor : 2.659
Load-Life Factor : 13.1786
Expected Average Life : 1.14621 108
****
Contact name     : DiCi
Max Normal Load  : 14.2291
Max Normal Stress : -194347.
Displacement     : 0.0000887709
Contact a-length : 0.0162522
Contact b-length : 0.0019762
Contact area     : 0.000100901
Distance to Corner: Dp : 0.00999777
Distance to Corner: Ds : 0.00999777
Effective Speed Factor : 2.659
Load-Life Factor : 14.9497
Expected Average Life : 1.89806 108
****
Contact name     : DsCo
Max Normal Load  : 22.4614
Max Normal Stress : -232897.
Displacement     : 0.000127495
Contact a-length : 0.019477
Contact b-length : 0.00236851
Contact area     : 0.000144926
Distance to Corner : -0.0175273
Effective Speed Factor : 2.659
Load-Life Factor : 9.47046
Expected Average Life : 3.0568 107

```

=====

Ball number : 36
Ball angle : 0.
Ball position : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 44.2689
Residual Force Vector : {0.083662, 0.476141, -0.247504}
Displacement Residual : 1.84667 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.1041
Max Normal Stress : -205694.
Displacement : 0.000099445
Contact a-length : 0.0172016
Contact b-length : 0.00209172
Contact area : 0.000113037
Distance to Corner : -0.0152519
Effective Speed Factor : 2.659
Load-Life Factor : 14.0836

8

Expected Average Life : 1.495 10

Contact name : DiCi
Max Normal Load : 14.3819
Max Normal Stress : -199774.
Displacement : 0.0000937981
Contact a-length : 0.0167061
Contact b-length : 0.00203139
Contact area : 0.000106615
Distance to Corner: Dp : 0.00954392
Distance to Corner: Ds : 0.00954392
Effective Speed Factor : 2.659
Load-Life Factor : 14.7908

8

Expected Average Life : 1.81866 10

Contact name : DsCi
Max Normal Load : 20.6104
Max Normal Stress : -225522.
Displacement : 0.000119522
Contact a-length : 0.0188583
Contact b-length : 0.00229292
Contact area : 0.000135844
Distance to Corner : -0.0169086
Effective Speed Factor : 2.659
Load-Life Factor : 10.321

7

Expected Average Life : 4.31196 10

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.319435

Total Internal Loads (Fx,Fy,Fz)
 Primary Disk : {-299.373, 52.9867, -252.672}
 Intermediate Disk : {4.28087, -1.85111, -22.7731}
 Secondary Disk : {307.704, -41.8446, 286.253}

Total Axial Torque (Tz)
 Primary Disk : 30.8403
 Intermediate Disk : 1207.89
 Secondary Disk : -1199.6

Torque Ratio: Ds/Dp : 38.8973
 Torque Ratio: Di/Dp : 39.1659
 Torque Ratio: Di/Ds : 1.00691

Torsional Stiffness (T/rad) : 215168.

Average Residual Force : {-0.350337, -0.258083, -0.300212}
 -6

Average Displacement Residual : 3.82939 10

Dp Speed : 10.
 Ds Speed : 0.27027
 Speed Conversion Ratio : 37.
 Effective N.D. Speed : 20.
 Minimum Expected Average Life

hours : 1.14621 10⁸
 years : 13084.6

Average Load-Life Factor: Dp : 14.2082
 Average Load-Life Factor: Di : 15.0849
 Average Load-Life Factor: Ds : 10.1408

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	:	-212338.
At ball number	:	35
Maximum Compressive Contact Stress Di	:	-199774.
At ball number	:	36
Maximum Compressive Contact Stress Ds	:	-225522.
At ball number	:	36
Maximum Ball Deflection Dp	:	0.000105962
At ball number	:	35
Maximum Ball Deflection Di	:	0.0000937981
At ball number	:	36
Maximum Ball Deflection Ds	:	0.000127495
At ball number	:	35
Maximum Ball Contact Area Dp	:	0.000120437
At ball number	:	35
Maximum Ball Contact Area Di	:	0.000106615
At ball number	:	36
Maximum Ball Contact Area Ds	:	0.000144926
At ball number	:	35
Maximum Ball a-patch Dp	:	0.0177563
At ball number	:	35
Maximum Ball a-patch Di	:	0.0167061
At ball number	:	36
Maximum Ball a-patch Ds	:	0.019477
At ball number	:	35
Maximum Ball b-patch Dp	:	0.00215902
At ball number	:	35
Maximum Ball b-patch Di	:	0.00203139
At ball number	:	36
Maximum Ball b-patch Ds	:	0.00236851
At ball number	:	35
Minimum Distance to Dp Corner	:	-0.0158066
At ball number	:	35
Minimum Distance to Di Corner: Dp	:	0.00954392
At ball number	:	36
Minimum Distance to Di Corner: Ds	:	0.00954392
At ball number	:	36
Minimum Distance to Ds Corner	:	-0.0175273
At ball number	:	35

=====
=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

**Precision Speed Reducer for Robotics and Manufacturing
(TRP-93-009)**

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 30 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter = 0.15625

ConformingDiameter = 0.1625

ConformingPercentage = 52.

PrimaryFlankAngleDegrees = 30.

IntermediateFlankAngleDegrees = 0.

SecondaryFlankAngleDegrees = 30.

PrimaryFractionBallDepth = 0.3

SecondaryFractionBallDepth = 0.3

ToleranceFraction = 0.01

ContactToCornerDistance for Dp = 0.0090211

ContactToCornerDistance for Ds = 0.0090211

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

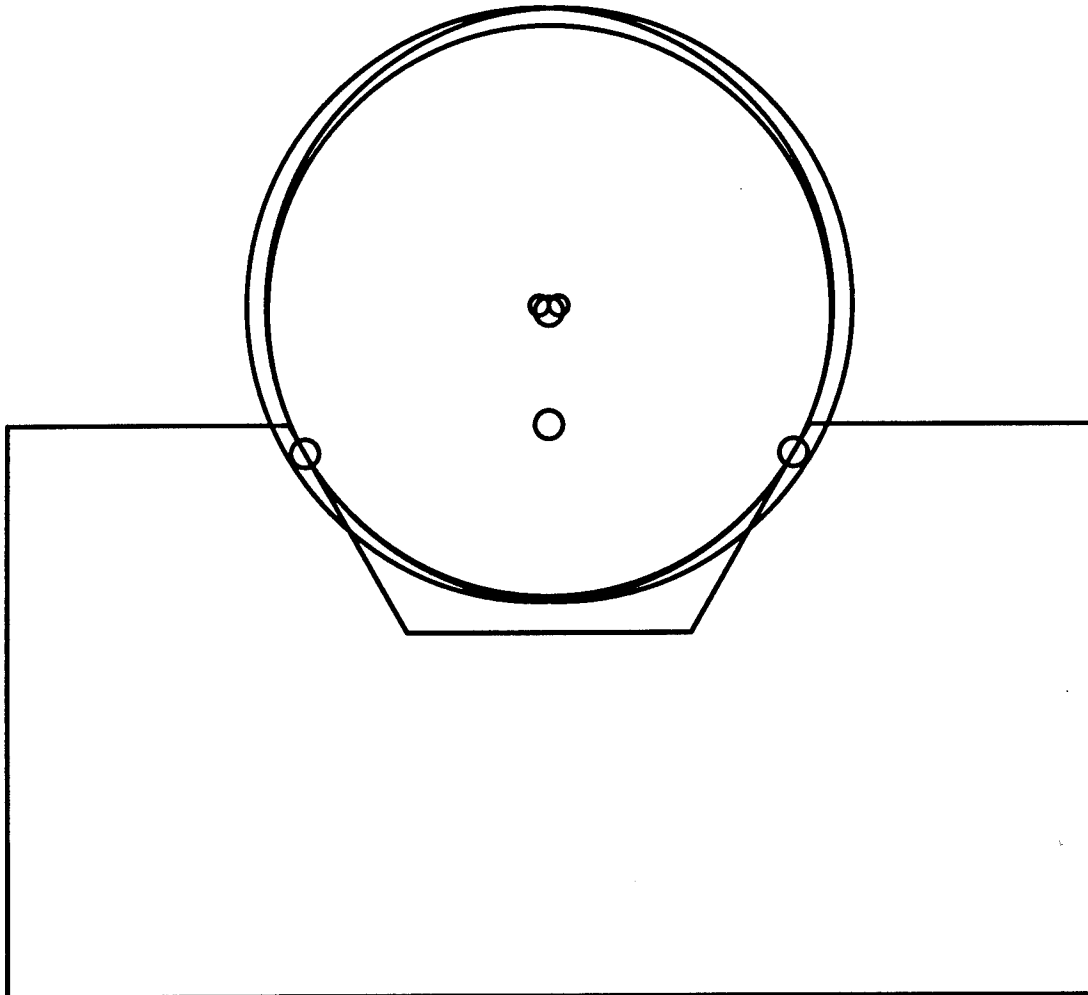
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots        = 36 (requested balls)

BallConjugateDirection        = forward drive
BallConstraintCondition        = exactly constrained

Conjugate constraints          = 36
Forward drive condition        = 36
Reverser drive condition      = 38
Predicted speed ratio         = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart             = 0.
PrimaryAngleFinish            = 5.
PrimaryAngleDelta              = 1.
PrimaryAngleNumber             = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

4.0 Numerical Results

Summary of Stress and Displacement Calculations

```

=====
Calculated for kinematic solution : 6
Angular Deformation                 : 0.337675
Applied Torque                      : 1199.6

```

```

=====
Ball number      : 1
Ball angle       : 350.
Ball position    : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 42.3158
Residual Force Vector : {0.175374, 0.434707, -0.245101}
Displacement Residual : 2.01273 10-6
****
Contact name     : DpCo
Max Normal Load  : 16.3162
Max Normal Stress : -210880.
Displacement     : 0.000104522
Contact a-length : 0.0176352
Contact b-length : 0.00214445
Contact area     : 0.000118808
Distance to Corner : -0.00861415
Effective Speed Factor : 2.659
Load-Life Factor : 13.0373
Expected Average Life : 1.09784 108
****
Contact name     : DiCi
Max Normal Load  : 14.5965
Max Normal Stress : -200267.
Displacement     : 0.0000942616
Contact a-length : 0.0167473
Contact b-length : 0.0020364
Contact area     : 0.000107142
Distance to Corner: Dp : 0.00950269
Distance to Corner: Ds : 0.00950269
Effective Speed Factor : 2.659
Load-Life Factor : 14.5733
Expected Average Life : 1.71404 108
****
Contact name     : DsCi
Max Normal Load  : 21.4959
Max Normal Stress : -229029.
Displacement     : 0.000123268
Contact a-length : 0.0191515
Contact b-length : 0.00232857
Contact area     : 0.000140101
Distance to Corner : -0.0101304
Effective Speed Factor : 2.659
Load-Life Factor : 9.89586
Expected Average Life : 3.64417 107

```

```
=====
Ball number      : 2
Ball angle       : 340.
Ball position    : {-0.640757, 2.39134, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 42.4275
Residual Force Vector : {0.0859235, 0.451453, -0.244184}
Displacement Residual : 1.97067 10-6
****
Contact name     : DpCo
Max Normal Load  : 16.2494
Max Normal Stress : -210577.
Displacement     : 0.000104222
Contact a-length : 0.0176099
Contact b-length : 0.00214137
Contact area     : 0.000118467
Distance to Corner : -0.0085888
Effective Speed Factor : 2.659
Load-Life Factor : 13.0909
Expected Average Life : 1.116 108
****
Contact name     : DiCi
Max Normal Load  : 14.5768
Max Normal Stress : -200224.
Displacement     : 0.0000942214
Contact a-length : 0.0167437
Contact b-length : 0.00203597
Contact area     : 0.000107096
Distance to Corner: Dp : 0.00950626
Distance to Corner: Ds : 0.00950626
Effective Speed Factor : 2.659
Load-Life Factor : 14.5931
Expected Average Life : 1.72335 108
****
Contact name     : DsCi
Max Normal Load  : 21.4407
Max Normal Stress : -228821.
Displacement     : 0.000123044
Contact a-length : 0.0191341
Contact b-length : 0.00232645
Contact area     : 0.000139847
Distance to Corner : -0.010113
Effective Speed Factor : 2.659
Load-Life Factor : 9.92133
Expected Average Life : 3.68183 107
```

```
=====
Ball number      : 3
Ball angle       : 330.
Ball position    : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 42.5397
Residual Force Vector : {-0.00357476, 0.450478, -0.243196}
                                     -6
Displacement Residual : 1.92866 10
****
Contact name      : DpCo
Max Normal Load   : 16.1825
Max Normal Stress : -210272.
Displacement      : 0.00010392
Contact a-length  : 0.0175844
Contact b-length  : 0.00213826
Contact area      : 0.000118124
Distance to Corner : -0.00856329
Effective Speed Factor : 2.659
Load-Life Factor  : 13.1451
                                     8
Expected Average Life : 1.13458 10
****
Contact name      : DiCi
Max Normal Load   : 14.5568
Max Normal Stress : -200180.
Displacement      : 0.00009418
Contact a-length  : 0.0167401
Contact b-length  : 0.00203552
Contact area      : 0.000107049
Distance to Corner: Dp : 0.00950994
Distance to Corner: Ds : 0.00950994
Effective Speed Factor : 2.659
Load-Life Factor  : 14.6131
                                     8
Expected Average Life : 1.73284 10
****
Contact name      : DsCi
Max Normal Load   : 21.3852
Max Normal Stress : -228611.
Displacement      : 0.000122819
Contact a-length  : 0.0191166
Contact b-length  : 0.00232432
Contact area      : 0.000139591
Distance to Corner : -0.0100955
Effective Speed Factor : 2.659
Load-Life Factor  : 9.94708
                                     7
Expected Average Life : 3.7202 10
```

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 42.6523
Residual Force Vector : {-0.0897156, 0.432353, -0.242136}

-6
Displacement Residual : 1.8867 10

Contact name : DpCo
Max Normal Load : 16.1154
Max Normal Stress : -209965.
Displacement : 0.000103617
Contact a-length : 0.0175587
Contact b-length : 0.00213514
Contact area : 0.000117779
Distance to Corner : -0.00853762
Effective Speed Factor : 2.659
Load-Life Factor : 13.1998

8
Expected Average Life : 1.1536 10

Contact name : DiCi
Max Normal Load : 14.5365
Max Normal Stress : -200135.
Displacement : 0.0000941374
Contact a-length : 0.0167363
Contact b-length : 0.00203506
Contact area : 0.000107001
Distance to Corner: Dp : 0.00951373
Distance to Corner: Ds : 0.00951373
Effective Speed Factor : 2.659
Load-Life Factor : 14.6335

8
Expected Average Life : 1.74252 10

Contact name : DsCi
Max Normal Load : 21.3293
Max Normal Stress : -228401.
Displacement : 0.000122593
Contact a-length : 0.019099
Contact b-length : 0.00232218
Contact area : 0.000139334
Distance to Corner : -0.0100779
Effective Speed Factor : 2.659
Load-Life Factor : 9.97312

7
Expected Average Life : 3.75931 10

=====

Ball number : 5
Ball angle : 310.
Ball position : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 42.7654
Residual Force Vector : {-0.169307, 0.398284, -0.241003}

Displacement Residual : 1.84481 10⁻⁶

Contact name : DpCo
Max Normal Load : 16.0481
Max Normal Stress : -209656.
Displacement : 0.000103312
Contact a-length : 0.0175329
Contact b-length : 0.002132
Contact area : 0.000117433
Distance to Corner : -0.00851178
Effective Speed Factor : 2.659
Load-Life Factor : 13.2551

Expected Average Life : 1.17306 10⁸

Contact name : DiCi
Max Normal Load : 14.516
Max Normal Stress : -200088.
Displacement : 0.0000940936
Contact a-length : 0.0167324
Contact b-length : 0.00203459
Contact area : 0.000106951
Distance to Corner: Dp : 0.00951763
Distance to Corner: Ds : 0.00951763
Effective Speed Factor : 2.659
Load-Life Factor : 14.6542

Expected Average Life : 1.75239 10⁸

Contact name : DsCi
Max Normal Load : 21.2732
Max Normal Stress : -228188.
Displacement : 0.000122365
Contact a-length : 0.0190813
Contact b-length : 0.00232002
Contact area : 0.000139075
Distance to Corner : -0.0100602
Effective Speed Factor : 2.659
Load-Life Factor : 9.99946

Expected Average Life : 3.79918 10⁷

=====

Ball number : 6
Ball angle : 300.
Ball position : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 42.879
Residual Force Vector : {-0.239484, 0.350056, -0.239796}

Displacement Residual : 1.80298 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.9807
Max Normal Stress : -209345.
Displacement : 0.000103006
Contact a-length : 0.0175069
Contact b-length : 0.00212884
Contact area : 0.000117085
Distance to Corner : -0.00848579
Effective Speed Factor : 2.659
Load-Life Factor : 13.3111

Expected Average Life : 1.19298 10⁸

Contact name : DiCi
Max Normal Load : 14.4952
Max Normal Stress : -200040.
Displacement : 0.0000940484
Contact a-length : 0.0167284
Contact b-length : 0.0020341
Contact area : 0.000106899
Distance to Corner: Dp : 0.00952164
Distance to Corner: Ds : 0.00952164
Effective Speed Factor : 2.659
Load-Life Factor : 14.6752

Expected Average Life : 1.76245 10⁸

Contact name : DsCi
Max Normal Load : 21.2167
Max Normal Stress : -227975.
Displacement : 0.000122136
Contact a-length : 0.0190634
Contact b-length : 0.00231785
Contact area : 0.000138815
Distance to Corner : -0.0100423
Effective Speed Factor : 2.659
Load-Life Factor : 10.0261

Expected Average Life : 3.83981 10⁷


```
=====
Ball number      : 7
Ball angle       : 290.
Ball position    : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 42.9931
Residual Force Vector : {-0.297817, 0.289953, -0.238514}
Displacement Residual : 1.76124 10-6
****
Contact name     : DpCo
Max Normal Load  : 15.9131
Max Normal Stress : -209032.
Displacement     : 0.000102699
Contact a-length : 0.0174807
Contact b-length : 0.00212566
Contact area     : 0.000116735
Distance to Corner : -0.00845963
Effective Speed Factor : 2.659
Load-Life Factor : 13.3676
Expected Average Life : 1.21337 108
****
Contact name     : DiCi
Max Normal Load  : 14.4742
Max Normal Stress : -199991.
Displacement     : 0.0000940021
Contact a-length : 0.0167242
Contact b-length : 0.0020336
Contact area     : 0.000106847
Distance to Corner: Dp : 0.00952576
Distance to Corner: Ds : 0.00952576
Effective Speed Factor : 2.659
Load-Life Factor : 14.6965
Expected Average Life : 1.77272 108
****
Contact name     : DsCi
Max Normal Load  : 21.1598
Max Normal Stress : -227760.
Displacement     : 0.000121906
Contact a-length : 0.0190454
Contact b-length : 0.00231567
Contact area     : 0.000138553
Distance to Corner : -0.0100243
Effective Speed Factor : 2.659
Load-Life Factor : 10.053
Expected Average Life : 3.88123 107
```

```
=====
Ball number      : 8
Ball angle       : 280.
Ball position    : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 43.1077
Residual Force Vector : {-0.342387, 0.22066, -0.237156}
Displacement Residual : 1.71959 10-6
****
Contact name     : DpCo
Max Normal Load  : 15.8454
Max Normal Stress : -208718.
Displacement     : 0.00010239
Contact a-length : 0.0174544
Contact b-length : 0.00212246
Contact area     : 0.000116384
Distance to Corner : -0.00843331
Effective Speed Factor : 2.659
Load-Life Factor : 13.4247
Expected Average Life : 1.23424 108
****
Contact name     : DiCi
Max Normal Load  : 14.4529
Max Normal Stress : -199940.
Displacement     : 0.0000939544
Contact a-length : 0.01672
Contact b-length : 0.00203308
Contact area     : 0.000106793
Distance to Corner: Dp : 0.00953
Distance to Corner: Ds : 0.00953
Effective Speed Factor : 2.659
Load-Life Factor : 14.7182
Expected Average Life : 1.78319 108
****
Contact name     : DsCi
Max Normal Load  : 21.1026
Max Normal Stress : -227543.
Displacement     : 0.000121674
Contact a-length : 0.0190273
Contact b-length : 0.00231347
Contact area     : 0.00013829
Distance to Corner : -0.0100062
Effective Speed Factor : 2.659
Load-Life Factor : 10.0803
Expected Average Life : 3.92346 107
```

```
=====
Ball number      : 9
Ball angle       : 270.
Ball position    : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 43.2227
Residual Force Vector : {-0.371857, 0.145154, -0.235722}
Displacement Residual : 1.67804 10-6
****
Contact name     : DpCo
Max Normal Load  : 15.7776
Max Normal Stress : -208401.
Displacement     : 0.000102079
Contact a-length : 0.0174279
Contact b-length : 0.00211923
Contact area     : 0.000116031
Distance to Corner : -0.00840682
Effective Speed Factor : 2.659
Load-Life Factor : 13.4824
Expected Average Life : 1.25562 108
****
Contact name     : DiCi
Max Normal Load  : 14.4313
Max Normal Stress : -199888.
Displacement     : 0.0000939055
Contact a-length : 0.0167156
Contact b-length : 0.00203255
Contact area     : 0.000106737
Distance to Corner: Dp : 0.00953436
Distance to Corner: Ds : 0.00953436
Effective Speed Factor : 2.659
Load-Life Factor : 14.7402
Expected Average Life : 1.79387 108
****
Contact name     : DsCi
Max Normal Load  : 21.0451
Max Normal Stress : -227326.
Displacement     : 0.000121442
Contact a-length : 0.0190091
Contact b-length : 0.00231126
Contact area     : 0.000138026
Distance to Corner : -0.00998802
Effective Speed Factor : 2.659
Load-Life Factor : 10.1078
Expected Average Life : 3.96653 107
```

=====

Ball number : 10
Ball angle : 260.
Ball position : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 43.3383
Residual Force Vector : {-0.385505, 0.0665829, -0.234209}

Displacement Residual : 1.63661 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.7095
Max Normal Stress : -208082.
Displacement : 0.000101767
Contact a-length : 0.0174013
Contact b-length : 0.00211599
Contact area : 0.000115676
Distance to Corner : -0.00838016
Effective Speed Factor : 2.659
Load-Life Factor : 13.5408

Expected Average Life : 1.2775 10⁸

Contact name : DiCi
Max Normal Load : 14.4095
Max Normal Stress : -199835.
Displacement : 0.0000938552
Contact a-length : 0.0167112
Contact b-length : 0.00203201
Contact area : 0.00010668
Distance to Corner: Dp : 0.00953883
Distance to Corner: Ds : 0.00953883
Effective Speed Factor : 2.659
Load-Life Factor : 14.7625

Expected Average Life : 1.80476 10⁸

Contact name : DsCi
Max Normal Load : 20.9873
Max Normal Stress : -227107.
Displacement : 0.000121208
Contact a-length : 0.0189908
Contact b-length : 0.00230903
Contact area : 0.00013776
Distance to Corner : -0.00996969
Effective Speed Factor : 2.659
Load-Life Factor : 10.1357

Expected Average Life : 4.01044 10⁷

=====

Ball number : 11
 Ball angle : 250.
 Ball position : {-2.28569, -0.612449, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 43.4543
 Residual Force Vector : {-0.383248, -0.0118608, -0.232617}

Displacement Residual : 1.59532 10⁻⁶

Contact name : DpCo
 Max Normal Load : 15.6414
 Max Normal Stress : -207761.
 Displacement : 0.000101454
 Contact a-length : 0.0173744
 Contact b-length : 0.00211273
 Contact area : 0.00011532
 Distance to Corner : -0.00835334
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.5998

Expected Average Life : 1.29992 10⁸

Contact name : DiCi
 Max Normal Load : 14.3874
 Max Normal Stress : -199780.
 Displacement : 0.0000938037
 Contact a-length : 0.0167066
 Contact b-length : 0.00203145
 Contact area : 0.000106621
 Distance to Corner: Dp : 0.00954342
 Distance to Corner: Ds : 0.00954342
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.7851

Expected Average Life : 1.81588 10⁸

Contact name : DsCi
 Max Normal Load : 20.9291
 Max Normal Stress : -226886.
 Displacement : 0.000120972
 Contact a-length : 0.0189723
 Contact b-length : 0.00230678
 Contact area : 0.000137492
 Distance to Corner : -0.00995125
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.1638

Expected Average Life : 4.05523 10⁷

=====

Ball number : 12
 Ball angle : 240.
 Ball position : {-2.1336, -0.994914, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 43.5708
 Residual Force Vector : {-0.365624, -0.0870619, -0.230946}

-6
 Displacement Residual : 1.55418 10

Contact name : DpCo
 Max Normal Load : 15.5731
 Max Normal Stress : -207439.
 Displacement : 0.000101139
 Contact a-length : 0.0173475
 Contact b-length : 0.00210945
 Contact area : 0.000114962
 Distance to Corner : -0.00832635
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.6595

8
 Expected Average Life : 1.32287 10

Contact name : DiCi
 Max Normal Load : 14.3651
 Max Normal Stress : -199723.
 Displacement : 0.0000937508
 Contact a-length : 0.0167019
 Contact b-length : 0.00203088
 Contact area : 0.000106561
 Distance to Corner: Dp : 0.00954813
 Distance to Corner: Ds : 0.00954813
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.8082

8
 Expected Average Life : 1.82721 10

Contact name : DsCi
 Max Normal Load : 20.8706
 Max Normal Stress : -226664.
 Displacement : 0.000120735
 Contact a-length : 0.0189538
 Contact b-length : 0.00230453
 Contact area : 0.000137223
 Distance to Corner : -0.00993268
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.1924

7
 Expected Average Life : 4.10092 10

```
=====
Ball number      : 13
Ball angle       : 230.
Ball position     : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 43.6878
Residual Force Vector : {-0.333768, -0.156104, -0.229193}
                                     -6
Displacement Residual : 1.5132 10
****
Contact name      : DpCo
Max Normal Load   : 15.5046
Max Normal Stress : -207114.
Displacement      : 0.000100822
Contact a-length  : 0.0173203
Contact b-length  : 0.00210615
Contact area      : 0.000114602
Distance to Corner : -0.00829919
Effective Speed Factor : 2.659
Load-Life Factor  : 13.7198
                                     8
Expected Average Life : 1.34639 10
****
Contact name      : DiCi
Max Normal Load   : 14.3424
Max Normal Stress : -199666.
Displacement      : 0.0000936966
Contact a-length  : 0.016697
Contact b-length  : 0.00203029
Contact area      : 0.000106499
Distance to Corner: Dp : 0.00955296
Distance to Corner: Ds : 0.00955296
Effective Speed Factor : 2.659
Load-Life Factor  : 14.8315
                                     8
Expected Average Life : 1.83877 10
****
Contact name      : DsCi
Max Normal Load   : 20.8117
Max Normal Stress : -226440.
Displacement      : 0.000120497
Contact a-length  : 0.0189351
Contact b-length  : 0.00230225
Contact area      : 0.000136953
Distance to Corner : -0.00991399
Effective Speed Factor : 2.659
Load-Life Factor  : 10.2212
                                     7
Expected Average Life : 4.14753 10
```

=====

Ball number : 14
 Ball angle : 220.
 Ball position : {-1.64746, -1.64746, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 43.8052
 Residual Force Vector : {-0.28935, -0.216378, -0.227358}

Displacement Residual : 1.47242 10⁻⁶

Contact name : DpCo
 Max Normal Load : 15.4361
 Max Normal Stress : -206787.
 Displacement : 0.000100504
 Contact a-length : 0.017293
 Contact b-length : 0.00210282
 Contact area : 0.000114241
 Distance to Corner : -0.00827187
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.7807

Expected Average Life : 1.37047 10⁸

Contact name : DiCi
 Max Normal Load : 14.3195
 Max Normal Stress : -199606.
 Displacement : 0.000093641
 Contact a-length : 0.0166921
 Contact b-length : 0.00202969
 Contact area : 0.000106436
 Distance to Corner: Dp : 0.00955792
 Distance to Corner: Ds : 0.00955792
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.8552

Expected Average Life : 1.85056 10⁸

Contact name : DsCi
 Max Normal Load : 20.7524
 Max Normal Stress : -226215.
 Displacement : 0.000120258
 Contact a-length : 0.0189163
 Contact b-length : 0.00229997
 Contact area : 0.000136681
 Distance to Corner : -0.00989518
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.2504

Expected Average Life : 4.19508 10⁷

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 43.9232
Residual Force Vector : {-0.234508, -0.265681, -0.22544}

Displacement Residual : 1.43185 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.3673
Max Normal Stress : -206458.
Displacement : 0.000100185
Contact a-length : 0.0172655
Contact b-length : 0.00209948
Contact area : 0.000113878
Distance to Corner : -0.00824437
Effective Speed Factor : 2.659
Load-Life Factor : 13.8423

Expected Average Life : 1.39515 10⁸

Contact name : DiCi
Max Normal Load : 14.2963
Max Normal Stress : -199546.
Displacement : 0.000093584
Contact a-length : 0.016687
Contact b-length : 0.00202907
Contact area : 0.000106372
Distance to Corner: Dp : 0.00956299
Distance to Corner: Ds : 0.00956299
Effective Speed Factor : 2.659
Load-Life Factor : 14.8793

Expected Average Life : 1.86259 10⁸

Contact name : DsCi
Max Normal Load : 20.6929
Max Normal Stress : -225989.
Displacement : 0.000120018
Contact a-length : 0.0188973
Contact b-length : 0.00229767
Contact area : 0.000136407
Distance to Corner : -0.00987624
Effective Speed Factor : 2.659
Load-Life Factor : 10.2799

Expected Average Life : 4.2436 10⁷

=====

Ball number : 16
Ball angle : 200.
Ball position : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 44.0417
Residual Force Vector : {-0.171747, -0.302294, -0.223439}
Displacement Residual : 1.39153 10⁻⁶

Contact name : DpCo
Max Normal Load : 15.2985
Max Normal Stress : -206127.
Displacement : 0.0000998639
Contact a-length : 0.0172378
Contact b-length : 0.00209611
Contact area : 0.000113513
Distance to Corner : -0.00821669
Effective Speed Factor : 2.659
Load-Life Factor : 13.9046

8

Expected Average Life : 1.42044 10

Contact name : DiCi
Max Normal Load : 14.2729
Max Normal Stress : -199484.
Displacement : 0.0000935257
Contact a-length : 0.0166818
Contact b-length : 0.00202844
Contact area : 0.000106305
Distance to Corner: Dp : 0.00956819
Distance to Corner: Ds : 0.00956819
Effective Speed Factor : 2.659
Load-Life Factor : 14.9038

8

Expected Average Life : 1.87486 10

Contact name : DsCi
Max Normal Load : 20.6329
Max Normal Stress : -225761.
Displacement : 0.000119776
Contact a-length : 0.0188783
Contact b-length : 0.00229535
Contact area : 0.000136132
Distance to Corner : -0.00985719
Effective Speed Factor : 2.659
Load-Life Factor : 10.3097

7

Expected Average Life : 4.29311 10

```
=====
Ball number      : 17
Ball angle       : 190.
Ball position    : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 44.1606
Residual Force Vector : {-0.103841, -0.325043, -0.221352}
Displacement Residual : 1.35148 10-6
****
Contact name     : DpCo
Max Normal Load  : 15.2295
Max Normal Stress : -205795.
Displacement     : 0.0000995416
Contact a-length : 0.0172099
Contact b-length : 0.00209273
Contact area     : 0.000113147
Distance to Corner : -0.00818885
Effective Speed Factor : 2.659
Load-Life Factor : 13.9676
Expected Average Life : 1.44635 108
****
Contact name     : DiCi
Max Normal Load  : 14.2492
Max Normal Stress : -199420.
Displacement     : 0.000093466
Contact a-length : 0.0166765
Contact b-length : 0.00202779
Contact area     : 0.000106237
Distance to Corner: Dp : 0.00957352
Distance to Corner: Ds : 0.00957352
Effective Speed Factor : 2.659
Load-Life Factor : 14.9286
Expected Average Life : 1.88738 108
****
Contact name     : DsCi
Max Normal Load  : 20.5727
Max Normal Stress : -225532.
Displacement     : 0.000119532
Contact a-length : 0.0188591
Contact b-length : 0.00229302
Contact area     : 0.000135856
Distance to Corner : -0.009838
Effective Speed Factor : 2.659
Load-Life Factor : 10.3399
Expected Average Life : 4.34364 107
```

=====

Ball number : 18
Ball angle : 180.
Ball position : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 36.0448
Residual Force Vector : {-1.21907, 0.862387, -0.477704}
Displacement Residual : 7.50605 10⁻⁶

Contact name : DpCi
Max Normal Load : 15.9532
Max Normal Stress : -212020.
Displacement : 0.000105646
Contact a-length : 0.0177298
Contact b-length : 0.0021558
Contact area : 0.000120078
Distance to Corner : -0.00870871
Effective Speed Factor : 2.659
Load-Life Factor : 13.334

Expected Average Life : 1.20122 10⁸

Contact name : DiCi
Max Normal Load : 14.3094
Max Normal Stress : -194128.
Displacement : 0.000088571
Contact a-length : 0.0162339
Contact b-length : 0.00197398
Contact area : 0.000100674
Distance to Corner: Dp : 0.0100161
Distance to Corner: Ds : 0.0100161
Effective Speed Factor : 2.659
Load-Life Factor : 14.8657

Expected Average Life : 1.8558 10⁸

Contact name : DsCo
Max Normal Load : 22.3389
Max Normal Stress : -232442.
Displacement : 0.000126996
Contact a-length : 0.0194389
Contact b-length : 0.00236387
Contact area : 0.00014436
Distance to Corner : -0.0104178
Effective Speed Factor : 2.659
Load-Life Factor : 9.52239

Expected Average Life : 3.12441 10⁷

=====

Ball number : 19
Ball angle : 170.
Ball position : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.9241
Residual Force Vector : {-1.37286, 0.630337, -0.473984}
Displacement Residual : 7.56894 10⁻⁶

Contact name : DpCi
Max Normal Load : 16.0356
Max Normal Stress : -212369.
Displacement : 0.000105993
Contact a-length : 0.017759
Contact b-length : 0.00215935
Contact area : 0.000120473
Distance to Corner : -0.00873786
Effective Speed Factor : 2.659
Load-Life Factor : 13.2655

8

Expected Average Life : 1.17672 10

Contact name : DiCi
Max Normal Load : 14.3311
Max Normal Stress : -194147.
Displacement : 0.0000885891
Contact a-length : 0.0162356
Contact b-length : 0.00197418
Contact area : 0.000100694
Distance to Corner: Dp : 0.0100144
Distance to Corner: Ds : 0.0100144
Effective Speed Factor : 2.659
Load-Life Factor : 14.8432

8

Expected Average Life : 1.84457 10

Contact name : DsCo
Max Normal Load : 22.4005
Max Normal Stress : -232683.
Displacement : 0.00012726
Contact a-length : 0.0194591
Contact b-length : 0.00236633
Contact area : 0.00014466
Distance to Corner : -0.010438
Effective Speed Factor : 2.659
Load-Life Factor : 9.4962

7

Expected Average Life : 3.09017 10

=====

Ball number : 20
Ball angle : 160.
Ball position : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.8039
Residual Force Vector : {-1.48228, 0.371206, -0.470205}

-6
Displacement Residual : 7.63145 10

Contact name : DpCi
Max Normal Load : 16.1179
Max Normal Stress : -212715.
Displacement : 0.000106339
Contact a-length : 0.0177879
Contact b-length : 0.00216287
Contact area : 0.000120866
Distance to Corner : -0.00876682
Effective Speed Factor : 2.659
Load-Life Factor : 13.1978

8
Expected Average Life : 1.15288 10

Contact name : DiCi
Max Normal Load : 14.3524
Max Normal Stress : -194166.
Displacement : 0.0000886056
Contact a-length : 0.0162371
Contact b-length : 0.00197436
Contact area : 0.000100713
Distance to Corner: Dp : 0.0100129
Distance to Corner: Ds : 0.0100129
Effective Speed Factor : 2.659
Load-Life Factor : 14.8212

8
Expected Average Life : 1.83363 10

Contact name : DsCo
Max Normal Load : 22.4618
Max Normal Stress : -232923.
Displacement : 0.000127522
Contact a-length : 0.0194792
Contact b-length : 0.00236876
Contact area : 0.000144958
Distance to Corner : -0.0104581
Effective Speed Factor : 2.659
Load-Life Factor : 9.47029

7
Expected Average Life : 3.05659 10

=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.6842
Residual Force Vector : {-1.54263, 0.0935029, -0.466371}

Displacement Residual : 7.69359 10⁻⁶

Contact name : DpCi
Max Normal Load : 16.2
Max Normal Stress : -213059.
Displacement : 0.000106684
Contact a-length : 0.0178167
Contact b-length : 0.00216636
Contact area : 0.000121257
Distance to Corner : -0.00879558
Effective Speed Factor : 2.659
Load-Life Factor : 13.1309

Expected Average Life : 1.12968 10⁸

Contact name : DiCi
Max Normal Load : 14.3733
Max Normal Stress : -194182.
Displacement : 0.0000886207
Contact a-length : 0.0162385
Contact b-length : 0.00197453
Contact area : 0.00010073
Distance to Corner: Dp : 0.0100115
Distance to Corner: Ds : 0.0100115
Effective Speed Factor : 2.659
Load-Life Factor : 14.7996

Expected Average Life : 1.82299 10⁸

Contact name : DsCo
Max Normal Load : 22.5228
Max Normal Stress : -233161.
Displacement : 0.000127783
Contact a-length : 0.0194991
Contact b-length : 0.00237118
Contact area : 0.000145254
Distance to Corner : -0.010478
Effective Speed Factor : 2.659
Load-Life Factor : 9.44467

Expected Average Life : 3.02364 10⁷

=====

Ball number : 22
Ball angle : 140.
Ball position : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.565
Residual Force Vector : {-1.55085, -0.193465, -0.462481}

-6
Displacement Residual : 7.75535 10

Contact name : DpCi
Max Normal Load : 16.282
Max Normal Stress : -213401.
Displacement : 0.000107026
Contact a-length : 0.0178453
Contact b-length : 0.00216984
Contact area : 0.000121647
Distance to Corner : -0.00882417
Effective Speed Factor : 2.659
Load-Life Factor : 13.0648

8

Expected Average Life : 1.10711 10

Contact name : DiCi
Max Normal Load : 14.3938
Max Normal Stress : -194197.
Displacement : 0.0000886344
Contact a-length : 0.0162397
Contact b-length : 0.00197468
Contact area : 0.000100746
Distance to Corner: Dp : 0.0100103
Distance to Corner: Ds : 0.0100103
Effective Speed Factor : 2.659
Load-Life Factor : 14.7786

8

Expected Average Life : 1.81264 10

Contact name : DsCo
Max Normal Load : 22.5834
Max Normal Stress : -233397.
Displacement : 0.000128042
Contact a-length : 0.0195188
Contact b-length : 0.00237359
Contact area : 0.000145549
Distance to Corner : -0.0104977
Effective Speed Factor : 2.659
Load-Life Factor : 9.41932

7

Expected Average Life : 2.99132 10


```
=====
Ball number      : 23
Ball angle       : 130.
Ball position    : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 35.4464
Residual Force Vector : {-1.50565, -0.479908, -0.458539}
Displacement Residual : 7.81674 10-6
```

```
Contact name      : DpCi
Max Normal Load   : 16.3638
Max Normal Stress : -213741.
Displacement      : 0.000107367
Contact a-length  : 0.0178737
Contact b-length  : 0.00217329
Contact area      : 0.000122034
Distance to Corner : -0.00885256
Effective Speed Factor : 2.659
Load-Life Factor  : 12.9994
```

```
Expected Average Life : 1.08513 108
```

```
Contact name      : DiCi
Max Normal Load   : 14.4139
Max Normal Stress : -194210.
Displacement      : 0.0000886465
Contact a-length  : 0.0162408
Contact b-length  : 0.00197482
Contact area      : 0.000100759
Distance to Corner: Dp : 0.0100092
Distance to Corner: Ds : 0.0100092
Effective Speed Factor : 2.659
Load-Life Factor  : 14.758
```

```
Expected Average Life : 1.80257 108
```

```
Contact name      : DsCo
Max Normal Load   : 22.6436
Max Normal Stress : -233632.
Displacement      : 0.0001283
Contact a-length  : 0.0195385
Contact b-length  : 0.00237598
Contact area      : 0.000145842
Distance to Corner : -0.0105174
Effective Speed Factor : 2.659
Load-Life Factor  : 9.39425
```

```
Expected Average Life : 2.95959 107
```

```
=====
Ball number      : 24
Ball angle       : 120.
Ball position    : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 35.3282
Residual Force Vector : {-1.40755, -0.755886, -0.454545}
                                     -6
Displacement Residual : 7.87775 10
****
Contact name      : DpCi
Max Normal Load   : 16.4454
Max Normal Stress : -214078.
Displacement      : 0.000107706
Contact a-length  : 0.0179019
Contact b-length  : 0.00217672
Contact area      : 0.00012242
Distance to Corner : -0.00888078
Effective Speed Factor : 2.659
Load-Life Factor  : 12.9349
                                     8
Expected Average Life : 1.06374 10
****
Contact name      : DiCi
Max Normal Load   : 14.4336
Max Normal Stress : -194222.
Displacement      : 0.0000886573
Contact a-length  : 0.0162418
Contact b-length  : 0.00197494
Contact area      : 0.000100772
Distance to Corner: Dp : 0.0100082
Distance to Corner: Ds : 0.0100082
Effective Speed Factor : 2.659
Load-Life Factor  : 14.7379
                                     8
Expected Average Life : 1.79277 10
****
Contact name      : DsCo
Max Normal Load   : 22.7036
Max Normal Stress : -233865.
Displacement      : 0.000128556
Contact a-length  : 0.0195579
Contact b-length  : 0.00237835
Contact area      : 0.000146133
Distance to Corner : -0.0105368
Effective Speed Factor : 2.659
Load-Life Factor  : 9.36944
                                     7
Expected Average Life : 2.92846 10
```

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.2105
Residual Force Vector : {-1.25897, -1.01165, -0.4505}

-6

Displacement Residual : 7.93839 10

Contact name : DpCi
Max Normal Load : 16.5269
Max Normal Stress : -214413.
Displacement : 0.000108044
Contact a-length : 0.0179299
Contact b-length : 0.00218013
Contact area : 0.000122803
Distance to Corner : -0.0089088
Effective Speed Factor : 2.659
Load-Life Factor : 12.8711

8

Expected Average Life : 1.04292 10

Contact name : DiCi
Max Normal Load : 14.4528
Max Normal Stress : -194232.
Displacement : 0.0000886666
Contact a-length : 0.0162427
Contact b-length : 0.00197504
Contact area : 0.000100782
Distance to Corner: Dp : 0.0100073
Distance to Corner: Ds : 0.0100073
Effective Speed Factor : 2.659
Load-Life Factor : 14.7183

8

Expected Average Life : 1.78324 10

Contact name : DsCo
Max Normal Load : 22.7632
Max Normal Stress : -234096.
Displacement : 0.000128811
Contact a-length : 0.0195773
Contact b-length : 0.0023807
Contact area : 0.000146422
Distance to Corner : -0.0105562
Effective Speed Factor : 2.659
Load-Life Factor : 9.3449

7

Expected Average Life : 2.8979 10

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.0933
Residual Force Vector : {-1.06406, -1.238, -0.446408}

-6
Displacement Residual : 7.99865 10

Contact name : DpCi
Max Normal Load : 16.6082
Max Normal Stress : -214746.
Displacement : 0.00010838
Contact a-length : 0.0179577
Contact b-length : 0.00218352
Contact area : 0.000123185
Distance to Corner : -0.00893665
Effective Speed Factor : 2.659
Load-Life Factor : 12.8081

8
Expected Average Life : 1.02264 10

Contact name : DiCi
Max Normal Load : 14.4716
Max Normal Stress : -194241.
Displacement : 0.0000886746
Contact a-length : 0.0162434
Contact b-length : 0.00197513
Contact area : 0.000100791
Distance to Corner: Dp : 0.0100066
Distance to Corner: Ds : 0.0100066
Effective Speed Factor : 2.659
Load-Life Factor : 14.6991

8
Expected Average Life : 1.77397 10

Contact name : DsCo
Max Normal Load : 22.8225
Max Normal Stress : -234326.
Displacement : 0.000129064
Contact a-length : 0.0195965
Contact b-length : 0.00238304
Contact area : 0.00014671
Distance to Corner : -0.0105754
Effective Speed Factor : 2.659
Load-Life Factor : 9.32063

7
Expected Average Life : 2.8679 10

=====

Ball number : 27
 Ball angle : 90.
 Ball position : {2.38153, -0.208357, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.9766
 Residual Force Vector : {-0.828684, -1.42657, -0.442268}

-6
 Displacement Residual : 8.05853 10

Contact name : DpCi
 Max Normal Load : 16.6894
 Max Normal Stress : -215077.
 Displacement : 0.000108714
 Contact a-length : 0.0179854
 Contact b-length : 0.00218688
 Contact area : 0.000123565
 Distance to Corner : -0.00896431
 Effective Speed Factor : 2.659
 Load-Life Factor : 12.7458

8
 Expected Average Life : 1.0029 10

Contact name : DiCi
 Max Normal Load : 14.4901
 Max Normal Stress : -194248.
 Displacement : 0.0000886811
 Contact a-length : 0.016244
 Contact b-length : 0.0019752
 Contact area : 0.000100799
 Distance to Corner: Dp : 0.010006
 Distance to Corner: Ds : 0.010006
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.6804

8
 Expected Average Life : 1.76496 10

Contact name : DsCo
 Max Normal Load : 22.8815
 Max Normal Stress : -234554.
 Displacement : 0.000129316
 Contact a-length : 0.0196156
 Contact b-length : 0.00238536
 Contact area : 0.000146996
 Distance to Corner : -0.0105945
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.2966

7
 Expected Average Life : 2.83845 10

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.8604
Residual Force Vector : {-0.560185, -1.57019, -0.438083}

Displacement Residual : 8.11804 10⁻⁶

Contact name : DpCi
Max Normal Load : 16.7703
Max Normal Stress : -215406.
Displacement : 0.000109046
Contact a-length : 0.0180129
Contact b-length : 0.00219022
Contact area : 0.000123943
Distance to Corner : -0.0089918
Effective Speed Factor : 2.659
Load-Life Factor : 12.6843

Expected Average Life : 9.8367 10⁷

Contact name : DiCi
Max Normal Load : 14.5081
Max Normal Stress : -194254.
Displacement : 0.0000886863
Contact a-length : 0.0162445
Contact b-length : 0.00197526
Contact area : 0.000100805
Distance to Corner: Dp : 0.0100055
Distance to Corner: Ds : 0.0100055
Effective Speed Factor : 2.659
Load-Life Factor : 14.6621

Expected Average Life : 1.75619 10⁸

Contact name : DsCo
Max Normal Load : 22.9401
Max Normal Stress : -234781.
Displacement : 0.000129566
Contact a-length : 0.0196346
Contact b-length : 0.00238767
Contact area : 0.000147281
Distance to Corner : -0.0106135
Effective Speed Factor : 2.659
Load-Life Factor : 9.27284

Expected Average Life : 2.80953 10⁷

=====

Ball number : 29
 Ball angle : 70.
 Ball position : {2.33264, 0.62503, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.7447
 Residual Force Vector : {-0.26717, -1.66311, -0.433853}

-6
 Displacement Residual : 8.17717 10

Contact name : DpCi
 Max Normal Load : 16.8511
 Max Normal Stress : -215732.
 Displacement : 0.000109377
 Contact a-length : 0.0180402
 Contact b-length : 0.00219354
 Contact area : 0.000124319
 Distance to Corner : -0.0090191
 Effective Speed Factor : 2.659
 Load-Life Factor : 12.6235

7
 Expected Average Life : 9.64939 10

Contact name : DiCi
 Max Normal Load : 14.5258
 Max Normal Stress : -194258.
 Displacement : 0.0000886902
 Contact a-length : 0.0162448
 Contact b-length : 0.00197531
 Contact area : 0.000100809
 Distance to Corner: Dp : 0.0100052
 Distance to Corner: Ds : 0.0100052
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.6443

8
 Expected Average Life : 1.74768 10

Contact name : DsCo
 Max Normal Load : 22.9984
 Max Normal Stress : -235006.
 Displacement : 0.000129814
 Contact a-length : 0.0196534
 Contact b-length : 0.00238996
 Contact area : 0.000147563
 Distance to Corner : -0.0106323
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.24932

7
 Expected Average Life : 2.78114 10

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.6294
Residual Force Vector : {0.0407676, -1.70122, -0.429582}

Displacement Residual : 8.23593 10⁻⁶

Contact name : DpCi
Max Normal Load : 16.9318
Max Normal Stress : -216057.
Displacement : 0.000109706
Contact a-length : 0.0180673
Contact b-length : 0.00219684
Contact area : 0.000124693
Distance to Corner : -0.00904623
Effective Speed Factor : 2.659
Load-Life Factor : 12.5634

Expected Average Life : 9.46691 10⁷

Contact name : DiCi
Max Normal Load : 14.543
Max Normal Stress : -194261.
Displacement : 0.0000886927
Contact a-length : 0.0162451
Contact b-length : 0.00197533
Contact area : 0.000100812
Distance to Corner: Dp : 0.0100049
Distance to Corner: Ds : 0.0100049
Effective Speed Factor : 2.659
Load-Life Factor : 14.627

Expected Average Life : 1.73941 10⁸

Contact name : DsCo
Max Normal Load : 23.0565
Max Normal Stress : -235230.
Displacement : 0.000130062
Contact a-length : 0.0196721
Contact b-length : 0.00239223
Contact area : 0.000147844
Distance to Corner : -0.010651
Effective Speed Factor : 2.659
Load-Life Factor : 9.22605

Expected Average Life : 2.75325 10⁷

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.5147
Residual Force Vector : {0.353368, -1.68224, -0.425269}

-6
Displacement Residual : 8.29432 10

Contact name : DpCi
Max Normal Load : 17.0122
Max Normal Stress : -216379.
Displacement : 0.000110034
Contact a-length : 0.0180943
Contact b-length : 0.00220011
Contact area : 0.000125065
Distance to Corner : -0.00907318
Effective Speed Factor : 2.659
Load-Life Factor : 12.504

7
Expected Average Life : 9.28913 10

Contact name : DiCi
Max Normal Load : 14.5598
Max Normal Stress : -194262.
Displacement : 0.0000886939
Contact a-length : 0.0162452
Contact b-length : 0.00197535
Contact area : 0.000100813
Distance to Corner: Dp : 0.0100048
Distance to Corner: Ds : 0.0100048
Effective Speed Factor : 2.659
Load-Life Factor : 14.61

8
Expected Average Life : 1.73137 10

Contact name : DsCo
Max Normal Load : 23.1142
Max Normal Stress : -235452.
Displacement : 0.000130307
Contact a-length : 0.0196907
Contact b-length : 0.00239449
Contact area : 0.000148124
Distance to Corner : -0.0106696
Effective Speed Factor : 2.659
Load-Life Factor : 9.20302

7
Expected Average Life : 2.72587 10

=====

Ball number : 32
Ball angle : 40.
Ball position : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.4005
Residual Force Vector : {0.660045, -1.6058, -0.420916}

-6
Displacement Residual : 8.35233 10

Contact name : DpCi
Max Normal Load : 17.0925
Max Normal Stress : -216699.
Displacement : 0.00011036
Contact a-length : 0.018121
Contact b-length : 0.00220337
Contact area : 0.000125435
Distance to Corner : -0.00909995
Effective Speed Factor : 2.659
Load-Life Factor : 12.4453

7
Expected Average Life : 9.11589 10

Contact name : DiCi
Max Normal Load : 14.5763
Max Normal Stress : -194262.
Displacement : 0.0000886937
Contact a-length : 0.0162452
Contact b-length : 0.00197534
Contact area : 0.000100813
Distance to Corner: Dp : 0.0100048
Distance to Corner: Ds : 0.0100048
Effective Speed Factor : 2.659
Load-Life Factor : 14.5935

8
Expected Average Life : 1.72356 10

Contact name : DsCo
Max Normal Load : 23.1715
Max Normal Stress : -235673.
Displacement : 0.000130552
Contact a-length : 0.0197092
Contact b-length : 0.00239673
Contact area : 0.000148401
Distance to Corner : -0.0106881
Effective Speed Factor : 2.659
Load-Life Factor : 9.18023

7
Expected Average Life : 2.69897 10

=====

Ball number : 33
 Ball angle : 30.
 Ball position : {1.41303, 2.01802, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.2867
 Residual Force Vector : {0.950249, -1.4735, -0.416525}
 Displacement Residual : 8.40996 10⁻⁶

Contact name : DpCi
 Max Normal Load : 17.1725
 Max Normal Stress : -217017.
 Displacement : 0.000110684
 Contact a-length : 0.0181476
 Contact b-length : 0.0022066
 Contact area : 0.000125804
 Distance to Corner : -0.00912655
 Effective Speed Factor : 2.659
 Load-Life Factor : 12.3872

Expected Average Life : 8.94706 10⁷

Contact name : DiCi
 Max Normal Load : 14.5924
 Max Normal Stress : -194261.
 Displacement : 0.0000886923
 Contact a-length : 0.016245
 Contact b-length : 0.00197533
 Contact area : 0.000100811
 Distance to Corner: Dp : 0.010005
 Distance to Corner: Ds : 0.010005
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.5775

Expected Average Life : 1.71599 10⁸

Contact name : DsCo
 Max Normal Load : 23.2286
 Max Normal Stress : -235892.
 Displacement : 0.000130794
 Contact a-length : 0.0197275
 Contact b-length : 0.00239896
 Contact area : 0.000148677
 Distance to Corner : -0.0107064
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.15768

Expected Average Life : 2.67254 10⁷

=====

Ball number : 34
Ball angle : 20.
Ball position : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.1735
Residual Force Vector : {1.21382, -1.28886, -0.412098}
-6
Displacement Residual : 8.46722 10

Contact name : DpCi
Max Normal Load : 17.2524
Max Normal Stress : -217333.
Displacement : 0.000111007
Contact a-length : 0.0181741
Contact b-length : 0.00220982
Contact area : 0.000126171
Distance to Corner : -0.00915297
Effective Speed Factor : 2.659
Load-Life Factor : 12.3299

7

Expected Average Life : 8.78251 10

Contact name : DiCi
Max Normal Load : 14.6081
Max Normal Stress : -194258.
Displacement : 0.0000886896
Contact a-length : 0.0162448
Contact b-length : 0.0019753
Contact area : 0.000100808
Distance to Corner: Dp : 0.0100052
Distance to Corner: Ds : 0.0100052
Effective Speed Factor : 2.659
Load-Life Factor : 14.5618

8

Expected Average Life : 1.70863 10

Contact name : DsCo
Max Normal Load : 23.2854
Max Normal Stress : -236109.
Displacement : 0.000131036
Contact a-length : 0.0197457
Contact b-length : 0.00240117
Contact area : 0.000148952
Distance to Corner : -0.0107246
Effective Speed Factor : 2.659
Load-Life Factor : 9.13535

7

Expected Average Life : 2.64658 10

=====

Ball number : 35
Ball angle : 10.
Ball position : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.0607
Residual Force Vector : {1.44136, -1.05726, -0.407635}
Displacement Residual : 8.5241 10⁻⁶

Contact name : DpCi
Max Normal Load : 17.3321
Max Normal Stress : -217647.
Displacement : 0.000111327
Contact a-length : 0.0182003
Contact b-length : 0.00221301
Contact area : 0.000126535
Distance to Corner : -0.00917923
Effective Speed Factor : 2.659
Load-Life Factor : 12.2732

Expected Average Life : 8.62211 10⁷

Contact name : DiCi
Max Normal Load : 14.6233
Max Normal Stress : -194253.
Displacement : 0.0000886857
Contact a-length : 0.0162444
Contact b-length : 0.00197525
Contact area : 0.000100804
Distance to Corner: Dp : 0.0100056
Distance to Corner: Ds : 0.0100056
Effective Speed Factor : 2.659
Load-Life Factor : 14.5466

Expected Average Life : 1.70149 10⁸

Contact name : DsCo
Max Normal Load : 23.3418
Max Normal Stress : -236325.
Displacement : 0.000131276
Contact a-length : 0.0197637
Contact b-length : 0.00240337
Contact area : 0.000149224
Distance to Corner : -0.0107426
Effective Speed Factor : 2.659
Load-Life Factor : 9.11326

Expected Average Life : 2.62107 10⁷

=====

Ball number : 36
Ball angle : 0.
Ball position : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 42.2046
Residual Force Vector : {0.261287, 0.400344, -0.245949}

-6
Displacement Residual : 2.05483 10

Contact name : DpCo
Max Normal Load : 16.3828
Max Normal Stress : -211181.
Displacement : 0.000104821
Contact a-length : 0.0176604
Contact b-length : 0.00214751
Contact area : 0.000119148
Distance to Corner : -0.00863934
Effective Speed Factor : 2.659
Load-Life Factor : 12.9843

8
Expected Average Life : 1.08009 10

Contact name : DiCi
Max Normal Load : 14.616
Max Normal Stress : -200308.
Displacement : 0.0000943006
Contact a-length : 0.0167508
Contact b-length : 0.00203682
Contact area : 0.000107186
Distance to Corner: Dp : 0.00949923
Distance to Corner: Ds : 0.00949923
Effective Speed Factor : 2.659
Load-Life Factor : 14.5539

8
Expected Average Life : 1.70491 10

Contact name : DsCi
Max Normal Load : 21.5507
Max Normal Stress : -229236.
Displacement : 0.000123491
Contact a-length : 0.0191688
Contact b-length : 0.00233067
Contact area : 0.000140355
Distance to Corner : -0.0101477
Effective Speed Factor : 2.659
Load-Life Factor : 9.87067

7
Expected Average Life : 3.6072 10

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.337675

Total Internal Loads (Fx,Fy,Fz)
 Primary Disk : {-306.402, 54.4919, -320.664}
 Intermediate Disk : {7.82861, -0.290143, -25.0068}
 Secondary Disk : {311.233, -41.2871, 357.896}

Total Axial Torque (Tz)
 Primary Disk : 30.7383
 Intermediate Disk : 1237.7
 Secondary Disk : -1199.6

Torque Ratio: Ds/Dp : 39.0262
 Torque Ratio: Di/Dp : 40.2657
 Torque Ratio: Di/Ds : 1.03176

Torsional Stiffness (T/rad) : 203544.

Average Residual Force : {-0.351653, -0.35874, -0.339563}
 -6

Average Displacement Residual : 4.86198 10

Dp Speed : 10.
 Ds Speed : 0.27027
 Speed Conversion Ratio : 37.
 Effective N.D. Speed : 20.
 Minimum Expected Average Life : 20.
 7

hours : 8.62211 10
 years : 9842.59

Average Load-Life Factor: Dp : 13.1243
 Average Load-Life Factor: Di : 14.7147
 Average Load-Life Factor: Ds : 9.70511

=====

Summary of Extreme Values

=====

Maximum Compressive Contact Stress Dp	:	-217647.
At ball number	:	35
Maximum Compressive Contact Stress Di	:	-200308.
At ball number	:	36
Maximum Compressive Contact Stress Ds	:	-229236.
At ball number	:	36
Maximum Ball Deflection Dp	:	0.000111327
At ball number	:	35
Maximum Ball Deflection Di	:	0.0000943006
At ball number	:	36
Maximum Ball Deflection Ds	:	0.000131276
At ball number	:	35
Maximum Ball Contact Area Dp	:	0.000126535
At ball number	:	35
Maximum Ball Contact Area Di	:	0.000107186
At ball number	:	36
Maximum Ball Contact Area Ds	:	0.000149224
At ball number	:	35
Maximum Ball a-patch Dp	:	0.0182003
At ball number	:	35
Maximum Ball a-patch Di	:	0.0167508
At ball number	:	36
Maximum Ball a-patch Ds	:	0.0197637
At ball number	:	35
Maximum Ball b-patch Dp	:	0.00221301
At ball number	:	35
Maximum Ball b-patch Di	:	0.00203682
At ball number	:	36
Maximum Ball b-patch Ds	:	0.00240337
At ball number	:	35
Minimum Distance to Dp Corner	:	-0.00917923
At ball number	:	35
Minimum Distance to Di Corner: Dp	:	0.00949923
At ball number	:	36
Minimum Distance to Di Corner: Ds	:	0.00949923
At ball number	:	36
Minimum Distance to Ds Corner	:	-0.0107426
At ball number	:	35

=====

=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing
(TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 35 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter	= 0.15625
ConformingDiameter	= 0.1625
ConformingPercentage	= 52.
PrimaryFlankAngleDegrees	= 35.
IntermediateFlankAngleDegrees	= 0.
SecondaryFlankAngleDegrees	= 35.
PrimaryFractionBallDepth	= 0.3
SecondaryFractionBallDepth	= 0.3
ToleranceFraction	= 0.01
ContactToCornerDistance for Dp	= 0.0165545
ContactToCornerDistance for Ds	= 0.0165545

Summary of Primary Disk Parameters

PrimaryDiskThickness	= 0.5
PrimaryDiskDiameter	= 6.
PrimaryRadiusMax	= 2.5
PrimaryRadiusMin	= 2.28125
PrimaryDisplacement	= 0.21875
PrimaryPhiIncrement	= 180.
PrimaryNumberLobes	= 1

Summary of Intermediate Disk Parameters

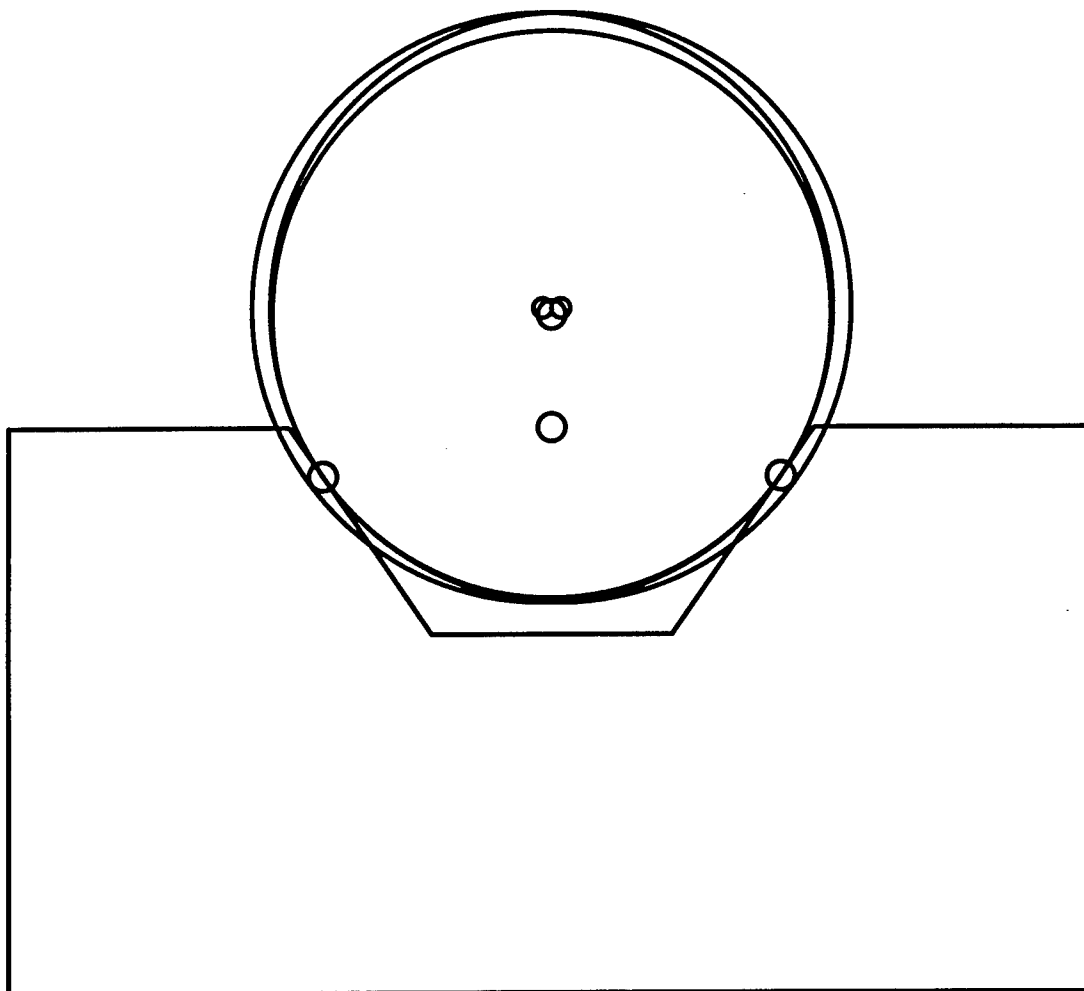
IntermediateDiskThickness	= 0.0525
IntermediateDiskDiameter	= 6.
IntermediateRadiusMax	= 2.5
IntermediateRadiusMin	= 2.28125
IntermediateDisplacement	= 0.21875
IntermediateSlotWidth	= 0.15625
IntermediateTotalSlots	= 36
IntermediateGammaIncrement	= 10.

Summary of Secondary Disk Parameters

SecondaryDiskThickness	= 0.5
SecondaryDiskDiameter	= 6.
SecondaryRadiusMax	= 2.5
SecondaryRadiusMin	= 2.28125
SecondaryDisplacement	= 0.21875
SecondaryPhiIncrement	= 4.86486
SecondaryNumberLobes	= 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition      = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta            = 1.
PrimaryAngleNumber           = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

Summary of Stress and Displacement Calculations

```

=====
Calculated for kinematic solution : 6
Angular Deformation                : 0.361843
Applied Torque                     : 1200.06

```

=====

Ball number : 1
Ball angle : 350.
Ball position : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 39.9249
Residual Force Vector : {0.353806, 0.371661, -0.211966}

Displacement Residual : 2.22825 10⁻⁶

Contact name : DpCo
Max Normal Load : 17.8859
Max Normal Stress : -217181.
Displacement : 0.000110862
Contact a-length : 0.0181622
Contact b-length : 0.00220853
Contact area : 0.000126015
Distance to Corner : -0.0016077
Effective Speed Factor : 2.659
Load-Life Factor : 11.8931

Expected Average Life : 7.60272 10⁷

Contact name : DiCi
Max Normal Load : 14.785
Max Normal Stress : -200633.
Displacement : 0.0000946071
Contact a-length : 0.016778
Contact b-length : 0.00204013
Contact area : 0.000107534
Distance to Corner: Dp : 0.00947203
Distance to Corner: Ds : 0.00947203
Effective Speed Factor : 2.659
Load-Life Factor : 14.3875

Expected Average Life : 1.62828 10⁸

Contact name : DsCi
Max Normal Load : 22.6498
Max Normal Stress : -233385.
Displacement : 0.000128002
Contact a-length : 0.0195158
Contact b-length : 0.00237286
Contact area : 0.000145482
Distance to Corner : -0.00296129
Effective Speed Factor : 2.659
Load-Life Factor : 9.3917

Expected Average Life : 2.95638 10⁷

=====

Ball number : 2
Ball angle : 340.
Ball position : {-0.640757, 2.39134, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.0297
Residual Force Vector : {0.272893, 0.42236, -0.212043}

-6
Displacement Residual : 2.18886 10

Contact name : DpCo
Max Normal Load : 17.8195
Max Normal Stress : -216903.
Displacement : 0.000110578
Contact a-length : 0.018139
Contact b-length : 0.0022057
Contact area : 0.000125692
Distance to Corner : -0.00158445
Effective Speed Factor : 2.659
Load-Life Factor : 11.9375

7
Expected Average Life : 7.71682 10

Contact name : DiCi
Max Normal Load : 14.7698
Max Normal Stress : -200608.
Displacement : 0.0000945829
Contact a-length : 0.0167758
Contact b-length : 0.00203987
Contact area : 0.000107507
Distance to Corner: Dp : 0.00947417
Distance to Corner: Ds : 0.00947417
Effective Speed Factor : 2.659
Load-Life Factor : 14.4024

8
Expected Average Life : 1.63502 10

Contact name : DsCi
Max Normal Load : 22.5968
Max Normal Stress : -233191.
Displacement : 0.000127789
Contact a-length : 0.0194996
Contact b-length : 0.00237088
Contact area : 0.00014524
Distance to Corner : -0.00294505
Effective Speed Factor : 2.659
Load-Life Factor : 9.41374

7
Expected Average Life : 2.98423 10

=====

Ball number : 3
Ball angle : 330.
Ball position : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.1349
Residual Force Vector : {0.185522, 0.456346, -0.212061}

-6
Displacement Residual : 2.14948 10

Contact name : DpCo
Max Normal Load : 17.7528
Max Normal Stress : -216623.
Displacement : 0.000110293
Contact a-length : 0.0181156
Contact b-length : 0.00220285
Contact area : 0.000125368
Distance to Corner : -0.00156105
Effective Speed Factor : 2.659
Load-Life Factor : 11.9823

7
Expected Average Life : 7.83339 10

Contact name : DiCi
Max Normal Load : 14.7543
Max Normal Stress : -200581.
Displacement : 0.0000945577
Contact a-length : 0.0167736
Contact b-length : 0.0020396
Contact area : 0.000107478
Distance to Corner: Dp : 0.00947641
Distance to Corner: Ds : 0.00947641
Effective Speed Factor : 2.659
Load-Life Factor : 14.4175

8
Expected Average Life : 1.64189 10

Contact name : DsCi
Max Normal Load : 22.5434
Max Normal Stress : -232995.
Displacement : 0.000127575
Contact a-length : 0.0194832
Contact b-length : 0.0023689
Contact area : 0.000144996
Distance to Corner : -0.00292871
Effective Speed Factor : 2.659
Load-Life Factor : 9.43601

7
Expected Average Life : 3.01258 10

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.2406
Residual Force Vector : {0.0950169, 0.47299, -0.212019}

-6
Displacement Residual : 2.11013 10

Contact name : DpCo
Max Normal Load : 17.686
Max Normal Stress : -216342.
Displacement : 0.000110007
Contact a-length : 0.018092
Contact b-length : 0.00219999
Contact area : 0.000125043
Distance to Corner : -0.00153751
Effective Speed Factor : 2.659
Load-Life Factor : 12.0276

7
Expected Average Life : 7.95249 10

Contact name : DiCi
Max Normal Load : 14.7386
Max Normal Stress : -200553.
Displacement : 0.0000945314
Contact a-length : 0.0167713
Contact b-length : 0.00203932
Contact area : 0.000107448
Distance to Corner: Dp : 0.00947875
Distance to Corner: Ds : 0.00947875
Effective Speed Factor : 2.659
Load-Life Factor : 14.4329

8
Expected Average Life : 1.6489 10

Contact name : DsCi
Max Normal Load : 22.4898
Max Normal Stress : -232799.
Displacement : 0.000127359
Contact a-length : 0.0194668
Contact b-length : 0.0023669
Contact area : 0.000144752
Distance to Corner : -0.00291226
Effective Speed Factor : 2.659
Load-Life Factor : 9.45852

7
Expected Average Life : 3.04142 10


```

=====
Ball number      : 5
Ball angle      : 310.
Ball position    : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 40.3468
Residual Force Vector : {0.00471047, 0.472298, -0.211916}
Displacement Residual : 2.07079 10-6
****
Contact name     : DpCo
Max Normal Load  : 17.6189
Max Normal Stress : -216059.
Displacement     : 0.000109719
Contact a-length : 0.0180683
Contact b-length : 0.00219711
Contact area     : 0.000124715
Distance to Corner : -0.00151383
Effective Speed Factor : 2.659
Load-Life Factor : 12.0734
Expected Average Life : 8.0742 107
****
Contact name     : DiCi
Max Normal Load  : 14.7226
Max Normal Stress : -200524.
Displacement     : 0.000094504
Contact a-length : 0.0167688
Contact b-length : 0.00203902
Contact area     : 0.000107417
Distance to Corner: Dp : 0.00948117
Distance to Corner: Ds : 0.00948117
Effective Speed Factor : 2.659
Load-Life Factor : 14.4485
Expected Average Life : 1.65605 108
****
Contact name     : DsCi
Max Normal Load  : 22.4358
Max Normal Stress : -232601.
Displacement     : 0.000127143
Contact a-length : 0.0194502
Contact b-length : 0.00236489
Contact area     : 0.000144506
Distance to Corner : -0.00289571
Effective Speed Factor : 2.659
Load-Life Factor : 9.48126
Expected Average Life : 3.07077 107

```

=====

Ball number : 6
Ball angle : 300.
Ball position : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.4534
Residual Force Vector : {-0.0821734, 0.454905, -0.211751}
Displacement Residual : 2.03148 10⁻⁶

Contact name : DpCo
Max Normal Load : 17.5517
Max Normal Stress : -215774.
Displacement : 0.00010943
Contact a-length : 0.0180445
Contact b-length : 0.00219421
Contact area : 0.000124387
Distance to Corner : -0.00149
Effective Speed Factor : 2.659
Load-Life Factor : 12.1196

Expected Average Life : 8.19858 10⁷

Contact name : DiCi
Max Normal Load : 14.7065
Max Normal Stress : -200494.
Displacement : 0.0000944755
Contact a-length : 0.0167663
Contact b-length : 0.00203871
Contact area : 0.000107385
Distance to Corner: Dp : 0.0094837
Distance to Corner: Ds : 0.0094837
Effective Speed Factor : 2.659
Load-Life Factor : 14.4644

Expected Average Life : 1.66335 10⁸

Contact name : DsCi
Max Normal Load : 22.3816
Max Normal Stress : -232402.
Displacement : 0.000126925
Contact a-length : 0.0194336
Contact b-length : 0.00236286
Contact area : 0.000144258
Distance to Corner : -0.00287906
Effective Speed Factor : 2.659
Load-Life Factor : 9.50423

Expected Average Life : 3.10064 10⁷

=====

Ball number : 7
Ball angle : 290.
Ball position : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.5604
Residual Force Vector : {-0.162634, 0.422025, -0.211524}

Displacement Residual : 1.99219 10⁻⁶

Contact name : DpCo
Max Normal Load : 17.4843
Max Normal Stress : -215487.
Displacement : 0.000109139
Contact a-length : 0.0180205
Contact b-length : 0.0021913
Contact area : 0.000124056
Distance to Corner : -0.00146603
Effective Speed Factor : 2.659
Load-Life Factor : 12.1663

Expected Average Life : 8.3257 10⁷

Contact name : DiCi
Max Normal Load : 14.6901
Max Normal Stress : -200463.
Displacement : 0.000094446
Contact a-length : 0.0167637
Contact b-length : 0.00203839
Contact area : 0.000107351
Distance to Corner: Dp : 0.00948632
Distance to Corner: Ds : 0.00948632
Effective Speed Factor : 2.659
Load-Life Factor : 14.4805

Expected Average Life : 1.67078 10⁸

Contact name : DsCi
Max Normal Load : 22.3271
Max Normal Stress : -232201.
Displacement : 0.000126707
Contact a-length : 0.0194168
Contact b-length : 0.00236082
Contact area : 0.00014401
Distance to Corner : -0.0028623
Effective Speed Factor : 2.659
Load-Life Factor : 9.52745

Expected Average Life : 3.13105 10⁷

=====

Ball number : 8
Ball angle : 280.
Ball position : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.6679
Residual Force Vector : {-0.233997, 0.3754, -0.211233}

-6
Displacement Residual : 1.95293 10

Contact name : DpCo
Max Normal Load : 17.4168
Max Normal Stress : -215199.
Displacement : 0.000108847
Contact a-length : 0.0179964
Contact b-length : 0.00218837
Contact area : 0.000123725
Distance to Corner : -0.00144192
Effective Speed Factor : 2.659
Load-Life Factor : 12.2135

7
Expected Average Life : 8.45563 10

Contact name : DiCi
Max Normal Load : 14.6735
Max Normal Stress : -200430.
Displacement : 0.0000944153
Contact a-length : 0.016761
Contact b-length : 0.00203806
Contact area : 0.000107316
Distance to Corner: Dp : 0.00948905
Distance to Corner: Ds : 0.00948905
Effective Speed Factor : 2.659
Load-Life Factor : 14.4969

8
Expected Average Life : 1.67837 10

Contact name : DsCi
Max Normal Load : 22.2722
Max Normal Stress : -232000.
Displacement : 0.000126487
Contact a-length : 0.0194
Contact b-length : 0.00235877
Contact area : 0.00014376
Distance to Corner : -0.00284544
Effective Speed Factor : 2.659
Load-Life Factor : 9.55091

7
Expected Average Life : 3.162 10

```
=====
Ball number      : 9
Ball angle       : 270.
Ball position    : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request     : solve
Cross over angle  : 40.7758
Residual Force Vector : {-0.294003, 0.317216, -0.210878}
Displacement Residual : 1.9137 10-6
****
Contact name     : DpCo
Max Normal Load  : 17.349
Max Normal Stress : -214909.
Displacement     : 0.000108554
Contact a-length : 0.0179722
Contact b-length : 0.00218541
Contact area     : 0.000123391
Distance to Corner : -0.00141766
Effective Speed Factor : 2.659
Load-Life Factor : 12.2612
Expected Average Life : 8.58845 107
****
Contact name     : DiCi
Max Normal Load  : 14.6566
Max Normal Stress : -200396.
Displacement     : 0.0000943835
Contact a-length : 0.0167581
Contact b-length : 0.00203772
Contact area     : 0.00010728
Distance to Corner: Dp : 0.00949187
Distance to Corner: Ds : 0.00949187
Effective Speed Factor : 2.659
Load-Life Factor : 14.5136
Expected Average Life : 1.68611 108
****
Contact name     : DsCi
Max Normal Load  : 22.2171
Max Normal Stress : -231797.
Displacement     : 0.000126266
Contact a-length : 0.019383
Contact b-length : 0.00235671
Contact area     : 0.000143508
Distance to Corner : -0.00282848
Effective Speed Factor : 2.659
Load-Life Factor : 9.57462
Expected Average Life : 3.19352 107
```

=====

Ball number : 10
Ball angle : 260.
Ball position : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.8842
Residual Force Vector : {-0.34088, 0.250012, -0.210457}

-6
Displacement Residual : 1.8745 10

Contact name : DpCo
Max Normal Load : 17.2811
Max Normal Stress : -214617.
Displacement : 0.000108259
Contact a-length : 0.0179478
Contact b-length : 0.00218245
Contact area : 0.000123056
Distance to Corner : -0.00139325
Effective Speed Factor : 2.659
Load-Life Factor : 12.3094

7
Expected Average Life : 8.72424 10

Contact name : DiCi
Max Normal Load : 14.6395
Max Normal Stress : -200361.
Displacement : 0.0000943506
Contact a-length : 0.0167552
Contact b-length : 0.00203736
Contact area : 0.000107243
Distance to Corner: Dp : 0.00949479
Distance to Corner: Ds : 0.00949479
Effective Speed Factor : 2.659
Load-Life Factor : 14.5306

8
Expected Average Life : 1.694 10

Contact name : DsCi
Max Normal Load : 22.1616
Max Normal Stress : -231593.
Displacement : 0.000126043
Contact a-length : 0.0193659
Contact b-length : 0.00235464
Contact area : 0.000143256
Distance to Corner : -0.00281141
Effective Speed Factor : 2.659
Load-Life Factor : 9.59858

7
Expected Average Life : 3.2256 10

=====

Ball number : 11
Ball angle : 250.
Ball position : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 40.993
Residual Force Vector : {-0.373393, 0.176581, -0.209969}

-6
Displacement Residual : 1.83533 10

Contact name : DpCo
Max Normal Load : 17.2131
Max Normal Stress : -214323.
Displacement : 0.000107963
Contact a-length : 0.0179232
Contact b-length : 0.00217946
Contact area : 0.00012272
Distance to Corner : -0.00136869
Effective Speed Factor : 2.659
Load-Life Factor : 12.3581

7
Expected Average Life : 8.86308 10

Contact name : DiCi
Max Normal Load : 14.6222
Max Normal Stress : -200325.
Displacement : 0.0000943165
Contact a-length : 0.0167522
Contact b-length : 0.002037
Contact area : 0.000107204
Distance to Corner: Dp : 0.00949782
Distance to Corner: Ds : 0.00949782
Effective Speed Factor : 2.659
Load-Life Factor : 14.5478

8
Expected Average Life : 1.70204 10

Contact name : DsCi
Max Normal Load : 22.1059
Max Normal Stress : -231387.
Displacement : 0.00012582
Contact a-length : 0.0193487
Contact b-length : 0.00235255
Contact area : 0.000143002
Distance to Corner : -0.00279423
Effective Speed Factor : 2.659
Load-Life Factor : 9.62279

7
Expected Average Life : 3.25828 10

=====

Ball number : 12
Ball angle : 240.
Ball position : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 41.1023
Residual Force Vector : {-0.390877, 0.099856, -0.209414}
Displacement Residual : 1.79621 10⁻⁶

Contact name : DpCo
Max Normal Load : 17.1448
Max Normal Stress : -214028.
Displacement : 0.000107666
Contact a-length : 0.0178985
Contact b-length : 0.00217646
Contact area : 0.000122382
Distance to Corner : -0.00134399
Effective Speed Factor : 2.659
Load-Life Factor : 12.4072

Expected Average Life : 9.00504 10⁷

Contact name : DiCi
Max Normal Load : 14.6046
Max Normal Stress : -200288.
Displacement : 0.0000942813
Contact a-length : 0.0167491
Contact b-length : 0.00203662
Contact area : 0.000107164
Distance to Corner: Dp : 0.00950094
Distance to Corner: Ds : 0.00950094
Effective Speed Factor : 2.659
Load-Life Factor : 14.5653

Expected Average Life : 1.71025 10⁸

Contact name : DsCi
Max Normal Load : 22.0498
Max Normal Stress : -231180.
Displacement : 0.000125595
Contact a-length : 0.0193315
Contact b-length : 0.00235045
Contact area : 0.000142746
Distance to Corner : -0.00277695
Effective Speed Factor : 2.659
Load-Life Factor : 9.64726

Expected Average Life : 3.29155 10⁷

=====

Ball number : 13
Ball angle : 230.
Ball position : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 41.2121
Residual Force Vector : {-0.393246, 0.0227972, -0.20879}

-6
Displacement Residual : 1.75713 10

Contact name : DpCo
Max Normal Load : 17.0764
Max Normal Stress : -213731.
Displacement : 0.000107367
Contact a-length : 0.0178736
Contact b-length : 0.00217343
Contact area : 0.000122042
Distance to Corner : -0.00131914
Effective Speed Factor : 2.659
Load-Life Factor : 12.457

7
Expected Average Life : 9.15021 10

Contact name : DiCi
Max Normal Load : 14.5868
Max Normal Stress : -200249.
Displacement : 0.0000942449
Contact a-length : 0.0167458
Contact b-length : 0.00203622
Contact area : 0.000107123
Distance to Corner: Dp : 0.00950418
Distance to Corner: Ds : 0.00950418
Effective Speed Factor : 2.659
Load-Life Factor : 14.5831

8
Expected Average Life : 1.71862 10

Contact name : DsCi
Max Normal Load : 21.9934
Max Normal Stress : -230972.
Displacement : 0.000125369
Contact a-length : 0.0193141
Contact b-length : 0.00234833
Contact area : 0.00014249
Distance to Corner : -0.00275955
Effective Speed Factor : 2.659
Load-Life Factor : 9.672

7
Expected Average Life : 3.32543 10

```
=====
Ball number      : 14
Ball angle       : 220.
Ball position    : {-1.64746, -1.64746, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 41.3223
Residual Force Vector : {-0.38098, -0.0517156, -0.208097}
Displacement Residual : 1.71809 10-6
****
Contact name     : DpCo
Max Normal Load  : 17.0078
Max Normal Stress : -213432.
Displacement     : 0.000107067
Contact a-length : 0.0178486
Contact b-length : 0.00217039
Contact area     : 0.000121701
Distance to Corner : -0.00129413
Effective Speed Factor : 2.659
Load-Life Factor : 12.5072
Expected Average Life : 9.29869 107
****
Contact name     : DiCi
Max Normal Load  : 14.5687
Max Normal Stress : -200209.
Displacement     : 0.0000942073
Contact a-length : 0.0167425
Contact b-length : 0.00203582
Contact area     : 0.00010708
Distance to Corner: Dp : 0.00950751
Distance to Corner: Ds : 0.00950751
Effective Speed Factor : 2.659
Load-Life Factor : 14.6011
Expected Average Life : 1.72715 108
****
Contact name     : DsCi
Max Normal Load  : 21.9367
Max Normal Stress : -230763.
Displacement     : 0.000125142
Contact a-length : 0.0192966
Contact b-length : 0.0023462
Contact area     : 0.000142231
Distance to Corner : -0.00274205
Effective Speed Factor : 2.659
Load-Life Factor : 9.697
Expected Average Life : 3.35995 107
```

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 41.4329
Residual Force Vector : {-0.355091, -0.120991, -0.207333}
-6
Displacement Residual : 1.6791 10

Contact name : DpCo
Max Normal Load : 16.9391
Max Normal Stress : -213131.
Displacement : 0.000106765
Contact a-length : 0.0178235
Contact b-length : 0.00216733
Contact area : 0.000121358
Distance to Corner : -0.00126898
Effective Speed Factor : 2.659
Load-Life Factor : 12.5579

7

Expected Average Life : 9.45055 10

Contact name : DiCi
Max Normal Load : 14.5504
Max Normal Stress : -200168.
Displacement : 0.0000941686
Contact a-length : 0.016739
Contact b-length : 0.0020354
Contact area : 0.000107036
Distance to Corner: Dp : 0.00951096
Distance to Corner: Ds : 0.00951096
Effective Speed Factor : 2.659
Load-Life Factor : 14.6195

8

Expected Average Life : 1.73586 10

Contact name : DsCi
Max Normal Load : 21.8797
Max Normal Stress : -230553.
Displacement : 0.000124914
Contact a-length : 0.019279
Contact b-length : 0.00234406
Contact area : 0.000141972
Distance to Corner : -0.00272444
Effective Speed Factor : 2.659
Load-Life Factor : 9.72227

7

Expected Average Life : 3.39511 10

=====

Ball number : 16
Ball angle : 200.
Ball position : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 41.544
Residual Force Vector : {-0.317071, -0.182622, -0.206498}

Displacement Residual : 1.64017 10⁻⁶

Contact name : DpCo
Max Normal Load : 16.8702
Max Normal Stress : -212829.
Displacement : 0.000106463
Contact a-length : 0.0177982
Contact b-length : 0.00216426
Contact area : 0.000121014
Distance to Corner : -0.00124368
Effective Speed Factor : 2.659
Load-Life Factor : 12.6092

Expected Average Life : 9.6059 10⁷

Contact name : DiCi
Max Normal Load : 14.5319
Max Normal Stress : -200125.
Displacement : 0.0000941286
Contact a-length : 0.0167355
Contact b-length : 0.00203497
Contact area : 0.000106991
Distance to Corner: Dp : 0.00951451
Distance to Corner: Ds : 0.00951451
Effective Speed Factor : 2.659
Load-Life Factor : 14.6381

Expected Average Life : 1.74473 10⁸

Contact name : DsCi
Max Normal Load : 21.8223
Max Normal Stress : -230341.
Displacement : 0.000124684
Contact a-length : 0.0192612
Contact b-length : 0.00234191
Contact area : 0.000141711
Distance to Corner : -0.00270672
Effective Speed Factor : 2.659
Load-Life Factor : 9.74781

Expected Average Life : 3.43093 10⁷

=====

Ball number : 17
 Ball angle : 190.
 Ball position : {-0.593576, -2.21526, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 41.6555
 Residual Force Vector : {-0.268824, -0.234565, -0.20559}

-6
 Displacement Residual : 1.6013 10

Contact name : DpCo
 Max Normal Load : 16.8011
 Max Normal Stress : -212524.
 Displacement : 0.000106158
 Contact a-length : 0.0177727
 Contact b-length : 0.00216116
 Contact area : 0.000120668
 Distance to Corner : -0.00121822
 Effective Speed Factor : 2.659
 Load-Life Factor : 12.6611

7
 Expected Average Life : 9.76483 10

Contact name : DiCi
 Max Normal Load : 14.5131
 Max Normal Stress : -200082.
 Displacement : 0.0000940875
 Contact a-length : 0.0167318
 Contact b-length : 0.00203452
 Contact area : 0.000106944
 Distance to Corner: Dp : 0.00951817
 Distance to Corner: Ds : 0.00951817
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.6571

8
 Expected Average Life : 1.75378 10

Contact name : DsCi
 Max Normal Load : 21.7647
 Max Normal Stress : -230127.
 Displacement : 0.000124454
 Contact a-length : 0.0192434
 Contact b-length : 0.00233974
 Contact area : 0.000141449
 Distance to Corner : -0.0026889
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.77363

7
 Expected Average Life : 3.46742 10

```

=====
Ball number          : 18
Ball angle           : 180.
Ball position        : {-0.198824, -2.27257, 0.}
Solution current?    : Yes
Ball activity        : ON
Ball request         : solve
Cross over angle     : 34.0325
Residual Force Vector : {-1.89269, 0.870011, -0.533329}
Displacement Residual : 9.90138 10-6
****
Contact name         : DpCi
Max Normal Load      : 17.4021
Max Normal Stress     : -218534.
Displacement         : 0.000112237
Contact a-length     : 0.0182745
Contact b-length     : 0.00222203
Contact area         : 0.000127569
Distance to Corner   : -0.00172
Effective Speed Factor : 2.659
Load-Life Factor      : 12.2238
Expected Average Life : 8.48421 107
****
Contact name         : DiCi
Max Normal Load      : 14.8595
Max Normal Stress     : -194075.
Displacement         : 0.0000885233
Contact a-length     : 0.0162295
Contact b-length     : 0.00197345
Contact area         : 0.000100619
Distance to Corner: Dp : 0.0100205
Distance to Corner: Ds : 0.0100205
Effective Speed Factor : 2.659
Load-Life Factor      : 14.3154
Expected Average Life : 1.59587 108
****
Contact name         : DsCo
Max Normal Load      : 23.4209
Max Normal Stress     : -236694.
Displacement         : 0.000131686
Contact a-length     : 0.0197946
Contact b-length     : 0.00240712
Contact area         : 0.00014969
Distance to Corner   : -0.00324007
Effective Speed Factor : 2.659
Load-Life Factor      : 9.08247
Expected Average Life : 2.58583 107

```

```
=====
Ball number      : 19
Ball angle       : 170.
Ball position    : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 33.919
Residual Force Vector : {-2.03449, 0.51747, -0.526311}
Displacement Residual : 9.9469 10-6
****
Contact name     : DpCi
Max Normal Load  : 17.4859
Max Normal Stress : -218851.
Displacement     : 0.000112562
Contact a-length : 0.018301
Contact b-length : 0.00222525
Contact area     : 0.000127939
Distance to Corner : -0.00174647
Effective Speed Factor : 2.659
Load-Life Factor : 12.1652
Expected Average Life : 8.32274 107
****
Contact name     : DiCi
Max Normal Load  : 14.8746
Max Normal Stress : -194076.
Displacement     : 0.0000885238
Contact a-length : 0.0162296
Contact b-length : 0.00197345
Contact area     : 0.00010062
Distance to Corner: Dp : 0.0100204
Distance to Corner: Ds : 0.0100204
Effective Speed Factor : 2.659
Load-Life Factor : 14.3009
Expected Average Life : 1.58943 108
****
Contact name     : DsCo
Max Normal Load  : 23.4788
Max Normal Stress : -236917.
Displacement     : 0.000131934
Contact a-length : 0.0198132
Contact b-length : 0.00240938
Contact area     : 0.000149972
Distance to Corner : -0.00325869
Effective Speed Factor : 2.659
Load-Life Factor : 9.06007
Expected Average Life : 2.56042 107
```

=====

Ball number : 20
Ball angle : 160.
Ball position : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.8059
Residual Force Vector : {-2.1106, 0.142446, -0.519291}

-6
Displacement Residual : 9.99216 10

Contact name : DpCi
Max Normal Load : 17.5695
Max Normal Stress : -219165.
Displacement : 0.000112886
Contact a-length : 0.0183273
Contact b-length : 0.00222845
Contact area : 0.000128307
Distance to Corner : -0.00177277
Effective Speed Factor : 2.659
Load-Life Factor : 12.1074

7
Expected Average Life : 8.16548 10

Contact name : DiCi
Max Normal Load : 14.8892
Max Normal Stress : -194075.
Displacement : 0.0000885231
Contact a-length : 0.0162295
Contact b-length : 0.00197344
Contact area : 0.000100619
Distance to Corner: Dp : 0.0100205
Distance to Corner: Ds : 0.0100205
Effective Speed Factor : 2.659
Load-Life Factor : 14.2869

8
Expected Average Life : 1.58318 10

Contact name : DsCo
Max Normal Load : 23.5365
Max Normal Stress : -237138.
Displacement : 0.00013218
Contact a-length : 0.0198317
Contact b-length : 0.00241163
Contact area : 0.000150252
Distance to Corner : -0.00327718
Effective Speed Factor : 2.659
Load-Life Factor : 9.03789

7
Expected Average Life : 2.53543 10

=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.6933
Residual Force Vector : {-0.0341258, -0.0259138, 0.0079104}

-7
Displacement Residual : 1.49594 10

Contact name : DpCi
Max Normal Load : 18.8273
Max Normal Stress : -219496.
Displacement : 0.000113227
Contact a-length : 0.0183549
Contact b-length : 0.00223181
Contact area : 0.000128695
Distance to Corner : -0.00180044
Effective Speed Factor : 2.659
Load-Life Factor : 11.2985

7
Expected Average Life : 6.19248 10

Contact name : DiCi
Max Normal Load : 13.018
Max Normal Stress : -193913.
Displacement : 0.0000883751
Contact a-length : 0.016216
Contact b-length : 0.00197179
Contact area : 0.000100451
Distance to Corner: Dp : 0.010034
Distance to Corner: Ds : 0.010034
Effective Speed Factor : 2.659
Load-Life Factor : 16.3405

8
Expected Average Life : 2.70919 10

Contact name : DsCo
Max Normal Load : 23.8197
Max Normal Stress : -237416.
Displacement : 0.00013249
Contact a-length : 0.0198549
Contact b-length : 0.00241446
Contact area : 0.000150605
Distance to Corner : -0.00330044
Effective Speed Factor : 2.659
Load-Life Factor : 8.9304

7
Expected Average Life : 2.41695 10

=====

Ball number : 22
 Ball angle : 140.
 Ball position : {1.33635, -1.90851, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 33.5812
 Residual Force Vector : {-0.0296393, -0.0317288, 0.00783508}

-7
 Displacement Residual : 1.52383 10

Contact name : DpCi
 Max Normal Load : 18.9074
 Max Normal Stress : -219808.
 Displacement : 0.000113549
 Contact a-length : 0.018381
 Contact b-length : 0.00223498
 Contact area : 0.00012906
 Distance to Corner : -0.0018265
 Effective Speed Factor : 2.659
 Load-Life Factor : 11.2506

7
 Expected Average Life : 6.08827 10

Contact name : DiCi
 Max Normal Load : 13.0173
 Max Normal Stress : -193906.
 Displacement : 0.0000883692
 Contact a-length : 0.0162154
 Contact b-length : 0.00197173
 Contact area : 0.000100444
 Distance to Corner: Dp : 0.0100346
 Distance to Corner: Ds : 0.0100346
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.3414

8
 Expected Average Life : 2.7098 10

Contact name : DsCo
 Max Normal Load : 23.8855
 Max Normal Stress : -237635.
 Displacement : 0.000132734
 Contact a-length : 0.0198732
 Contact b-length : 0.00241668
 Contact area : 0.000150882
 Distance to Corner : -0.00331871
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.90582

7
 Expected Average Life : 2.39045 10

=====

Ball number : 23
Ball angle : 130.
Ball position : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.4696
Residual Force Vector : {-0.024154, -0.0367644, 0.00775943}

-7
Displacement Residual : 1.55177 10

Contact name : DpCi
Max Normal Load : 18.9871
Max Normal Stress : -220117.
Displacement : 0.000113869
Contact a-length : 0.0184069
Contact b-length : 0.00223813
Contact area : 0.000129424
Distance to Corner : -0.00185239
Effective Speed Factor : 2.659
Load-Life Factor : 11.2034

7
Expected Average Life : 5.98658 10

Contact name : DiCi
Max Normal Load : 13.0163
Max Normal Stress : -193899.
Displacement : 0.0000883621
Contact a-length : 0.0162148
Contact b-length : 0.00197165
Contact area : 0.000100436
Distance to Corner: Dp : 0.0100352
Distance to Corner: Ds : 0.0100352
Effective Speed Factor : 2.659
Load-Life Factor : 16.3426

8
Expected Average Life : 2.71063 10

Contact name : DsCo
Max Normal Load : 23.951
Max Normal Stress : -237852.
Displacement : 0.000132977
Contact a-length : 0.0198914
Contact b-length : 0.00241889
Contact area : 0.000151158
Distance to Corner : -0.00333687
Effective Speed Factor : 2.659
Load-Life Factor : 8.88148

7
Expected Average Life : 2.36443 10

```
=====
Ball number      : 24
Ball angle       : 120.
Ball position    : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 33.3584
Residual Force Vector : {-0.0178059, -0.0408475, 0.00768347}
Displacement Residual : 1.57978 10-7
****
Contact name     : DpCi
Max Normal Load  : 19.0666
Max Normal Stress : -220425.
Displacement     : 0.000114188
Contact a-length : 0.0184326
Contact b-length : 0.00224126
Contact area     : 0.000129786
Distance to Corner : -0.00187812
Effective Speed Factor : 2.659
Load-Life Factor : 11.1567
Expected Average Life : 5.88735 107
****
Contact name     : DiCi
Max Normal Load  : 13.015
Max Normal Stress : -193889.
Displacement     : 0.0000883537
Contact a-length : 0.016214
Contact b-length : 0.00197156
Contact area     : 0.000100427
Distance to Corner: Dp : 0.010036
Distance to Corner: Ds : 0.010036
Effective Speed Factor : 2.659
Load-Life Factor : 16.3442
Expected Average Life : 2.71169 108
****
Contact name     : DsCo
Max Normal Load  : 24.0161
Max Normal Stress : -238067.
Displacement     : 0.000133218
Contact a-length : 0.0199094
Contact b-length : 0.00242109
Contact area     : 0.000151432
Distance to Corner : -0.0033549
Effective Speed Factor : 2.659
Load-Life Factor : 8.8574
Expected Average Life : 2.33888 107
```

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.2476
Residual Force Vector : {-0.0107614, -0.0438293, 0.00760722}
Displacement Residual : 1.60783 10⁻⁷

Contact name : DpCi
Max Normal Load : 19.1459
Max Normal Stress : -220731.
Displacement : 0.000114505
Contact a-length : 0.0184582
Contact b-length : 0.00224437
Contact area : 0.000130147
Distance to Corner : -0.00190369
Effective Speed Factor : 2.659
Load-Life Factor : 11.1105

Expected Average Life : 5.7905 10⁷

Contact name : DiCi
Max Normal Load : 13.0135
Max Normal Stress : -193879.
Displacement : 0.0000883442
Contact a-length : 0.0162131
Contact b-length : 0.00197145
Contact area : 0.000100416
Distance to Corner: Dp : 0.0100369
Distance to Corner: Ds : 0.0100369
Effective Speed Factor : 2.659
Load-Life Factor : 16.3462

Expected Average Life : 2.71298 10⁸

Contact name : DsCo
Max Normal Load : 24.0809
Max Normal Stress : -238281.
Displacement : 0.000133458
Contact a-length : 0.0199273
Contact b-length : 0.00242326
Contact area : 0.000151705
Distance to Corner : -0.00337281
Effective Speed Factor : 2.659
Load-Life Factor : 8.83355

Expected Average Life : 2.3138 10⁷

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.1374
Residual Force Vector : {-0.00321263, -0.0455899, 0.00753071}

-7
Displacement Residual : 1.63593 10

Contact name : DpCi
Max Normal Load : 19.2248
Max Normal Stress : -221035.
Displacement : 0.00011482
Contact a-length : 0.0184836
Contact b-length : 0.00224746
Contact area : 0.000130505
Distance to Corner : -0.0019291
Effective Speed Factor : 2.659
Load-Life Factor : 11.0649

7
Expected Average Life : 5.69597 10

Contact name : DiCi
Max Normal Load : 13.0116
Max Normal Stress : -193867.
Displacement : 0.0000883333
Contact a-length : 0.0162121
Contact b-length : 0.00197133
Contact area : 0.000100403
Distance to Corner: Dp : 0.0100379
Distance to Corner: Ds : 0.0100379
Effective Speed Factor : 2.659
Load-Life Factor : 16.3484

8
Expected Average Life : 2.71449 10

Contact name : DsCo
Max Normal Load : 24.1454
Max Normal Stress : -238494.
Displacement : 0.000133696
Contact a-length : 0.0199451
Contact b-length : 0.00242543
Contact area : 0.000151976
Distance to Corner : -0.00339061
Effective Speed Factor : 2.659
Load-Life Factor : 8.80995

7
Expected Average Life : 2.28917 10

=====

Ball number : 27
Ball angle : 90.
Ball position : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 33.0275
Residual Force Vector : {0.00462752, -0.0460432, 0.00745395}

-7
Displacement Residual : 1.66407 10

Contact name : DpCi
Max Normal Load : 19.3035
Max Normal Stress : -221337.
Displacement : 0.000115134
Contact a-length : 0.0185089
Contact b-length : 0.00225053
Contact area : 0.000130862
Distance to Corner : -0.00195435
Effective Speed Factor : 2.659
Load-Life Factor : 11.0198

7
Expected Average Life : 5.60369 10

Contact name : DiCi
Max Normal Load : 13.0096
Max Normal Stress : -193854.
Displacement : 0.0000883213
Contact a-length : 0.016211
Contact b-length : 0.00197119
Contact area : 0.00010039
Distance to Corner: Dp : 0.010039
Distance to Corner: Ds : 0.010039
Effective Speed Factor : 2.659
Load-Life Factor : 16.351

8
Expected Average Life : 2.71622 10

Contact name : DsCo
Max Normal Load : 24.2096
Max Normal Stress : -238706.
Displacement : 0.000133933
Contact a-length : 0.0199628
Contact b-length : 0.00242758
Contact area : 0.000152245
Distance to Corner : -0.00340828
Effective Speed Factor : 2.659
Load-Life Factor : 8.78659

7
Expected Average Life : 2.26499 10

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.9182
Residual Force Vector : {0.0125313, -0.0451405, 0.00737698}

-7
Displacement Residual : 1.69224 10

Contact name : DpCi
Max Normal Load : 19.3819
Max Normal Stress : -221637.
Displacement : 0.000115446
Contact a-length : 0.018534
Contact b-length : 0.00225358
Contact area : 0.000131217
Distance to Corner : -0.00197945
Effective Speed Factor : 2.659
Load-Life Factor : 10.9752

7
Expected Average Life : 5.51359 10

Contact name : DiCi
Max Normal Load : 13.0072
Max Normal Stress : -193839.
Displacement : 0.0000883081
Contact a-length : 0.0162098
Contact b-length : 0.00197105
Contact area : 0.000100375
Distance to Corner: Dp : 0.0100402
Distance to Corner: Ds : 0.0100402
Effective Speed Factor : 2.659
Load-Life Factor : 16.354

8
Expected Average Life : 2.71817 10

Contact name : DsCo
Max Normal Load : 24.2735
Max Normal Stress : -238916.
Displacement : 0.000134169
Contact a-length : 0.0199804
Contact b-length : 0.00242971
Contact area : 0.000152513
Distance to Corner : -0.00342584
Effective Speed Factor : 2.659
Load-Life Factor : 8.76347

7
Expected Average Life : 2.24124 10

=====

Ball number : 29
Ball angle : 70.
Ball position : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.8093
Residual Force Vector : {0.0202627, -0.0428731, 0.0072998}

-7
Displacement Residual : 1.72044 10

Contact name : DpCi
Max Normal Load : 19.46
Max Normal Stress : -221935.
Displacement : 0.000115757
Contact a-length : 0.0185589
Contact b-length : 0.00225661
Contact area : 0.00013157
Distance to Corner : -0.00200438
Effective Speed Factor : 2.659
Load-Life Factor : 10.9312

7
Expected Average Life : 5.4256 10

Contact name : DiCi
Max Normal Load : 13.0046
Max Normal Stress : -193824.
Displacement : 0.0000882938
Contact a-length : 0.0162085
Contact b-length : 0.00197089
Contact area : 0.000100358
Distance to Corner: Dp : 0.0100415
Distance to Corner: Ds : 0.0100415
Effective Speed Factor : 2.659
Load-Life Factor : 16.3572

8
Expected Average Life : 2.72034 10

Contact name : DsCo
Max Normal Load : 24.3371
Max Normal Stress : -239124.
Displacement : 0.000134403
Contact a-length : 0.0199978
Contact b-length : 0.00243183
Contact area : 0.00015278
Distance to Corner : -0.00344329
Effective Speed Factor : 2.659
Load-Life Factor : 8.74058

7
Expected Average Life : 2.21791 10

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.7009
Residual Force Vector : {0.0275847, -0.0392735, 0.00722245}

-7
Displacement Residual : 1.74866 10

Contact name : DpCi
Max Normal Load : 19.5378
Max Normal Stress : -222231.
Displacement : 0.000116067
Contact a-length : 0.0185837
Contact b-length : 0.00225962
Contact area : 0.000131922
Distance to Corner : -0.00202916
Effective Speed Factor : 2.659
Load-Life Factor : 10.8876

7
Expected Average Life : 5.33968 10

Contact name : DiCi
Max Normal Load : 13.0018
Max Normal Stress : -193807.
Displacement : 0.0000882782
Contact a-length : 0.0162071
Contact b-length : 0.00197071
Contact area : 0.000100341
Distance to Corner: Dp : 0.0100429
Distance to Corner: Ds : 0.0100429
Effective Speed Factor : 2.659
Load-Life Factor : 16.3608

8
Expected Average Life : 2.72273 10

Contact name : DsCo
Max Normal Load : 24.4003
Max Normal Stress : -239331.
Displacement : 0.000134637
Contact a-length : 0.0200151
Contact b-length : 0.00243394
Contact area : 0.000153045
Distance to Corner : -0.00346062
Effective Speed Factor : 2.659
Load-Life Factor : 8.71792

7
Expected Average Life : 2.195 10

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.5929
Residual Force Vector : {0.0342663, -0.0344156, 0.00714495}

-7
Displacement Residual : 1.7769 10

Contact name : DpCi
Max Normal Load : 19.6153
Max Normal Stress : -222526.
Displacement : 0.000116374
Contact a-length : 0.0186083
Contact b-length : 0.00226261
Contact area : 0.000132272
Distance to Corner : -0.00205378
Effective Speed Factor : 2.659
Load-Life Factor : 10.8446

7
Expected Average Life : 5.25576 10

Contact name : DiCi
Max Normal Load : 12.9987
Max Normal Stress : -193788.
Displacement : 0.0000882616
Contact a-length : 0.0162055
Contact b-length : 0.00197053
Contact area : 0.000100322
Distance to Corner: Dp : 0.0100445
Distance to Corner: Ds : 0.0100445
Effective Speed Factor : 2.659
Load-Life Factor : 16.3647

8
Expected Average Life : 2.72533 10

Contact name : DsCo
Max Normal Load : 24.4633
Max Normal Stress : -239537.
Displacement : 0.000134868
Contact a-length : 0.0200323
Contact b-length : 0.00243604
Contact area : 0.000153308
Distance to Corner : -0.00347783
Effective Speed Factor : 2.659
Load-Life Factor : 8.69548

7
Expected Average Life : 2.17249 10

```
=====
Ball number      : 32
Ball angle       : 40.
Ball position    : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 32.4854
Residual Force Vector : {0.04009, -0.0284139, 0.0070673}
                                     -7
Displacement Residual : 1.80515 10
****
Contact name      : DpCi
Max Normal Load   : 19.6926
Max Normal Stress : -222819.
Displacement      : 0.00011668
Contact a-length  : 0.0186328
Contact b-length  : 0.00226559
Contact area      : 0.00013262
Distance to Corner : -0.00207825
Effective Speed Factor : 2.659
Load-Life Factor  : 10.802
                                     7
Expected Average Life : 5.17377 10
****
Contact name      : DiCi
Max Normal Load   : 12.9953
Max Normal Stress : -193769.
Displacement      : 0.0000882437
Contact a-length  : 0.0162039
Contact b-length  : 0.00197033
Contact area      : 0.000100302
Distance to Corner: Dp : 0.0100461
Distance to Corner: Ds : 0.0100461
Effective Speed Factor : 2.659
Load-Life Factor  : 16.369
                                     8
Expected Average Life : 2.72815 10
****
Contact name      : DsCo
Max Normal Load   : 24.5259
Max Normal Stress : -239742.
Displacement      : 0.000135099
Contact a-length  : 0.0200494
Contact b-length  : 0.00243812
Contact area      : 0.00015357
Distance to Corner : -0.00349493
Effective Speed Factor : 2.659
Load-Life Factor  : 8.67327
                                     7
Expected Average Life : 2.15038 10
```

=====

Ball number : 33
Ball angle : 30.
Ball position : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.3783
Residual Force Vector : {0.0448586, -0.0214204, 0.00698954}

-7
Displacement Residual : 1.83341 10

Contact name : DpCi
Max Normal Load : 19.7695
Max Normal Stress : -223109.
Displacement : 0.000116985
Contact a-length : 0.0186571
Contact b-length : 0.00226854
Contact area : 0.000132966
Distance to Corner : -0.00210256
Effective Speed Factor : 2.659
Load-Life Factor : 10.76

7
Expected Average Life : 5.09368 10

Contact name : DiCi
Max Normal Load : 12.9917
Max Normal Stress : -193748.
Displacement : 0.0000882248
Contact a-length : 0.0162022
Contact b-length : 0.00197012
Contact area : 0.00010028
Distance to Corner: Dp : 0.0100478
Distance to Corner: Ds : 0.0100478
Effective Speed Factor : 2.659
Load-Life Factor : 16.3735

8
Expected Average Life : 2.73117 10

Contact name : DsCo
Max Normal Load : 24.5883
Max Normal Stress : -239945.
Displacement : 0.000135328
Contact a-length : 0.0200664
Contact b-length : 0.00244018
Contact area : 0.00015383
Distance to Corner : -0.00351192
Effective Speed Factor : 2.659
Load-Life Factor : 8.65128

7
Expected Average Life : 2.12866 10

=====

Ball number : 34
Ball angle : 20.
Ball position : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.2717
Residual Force Vector : {0.0484022, -0.0136214, 0.00691169}

Displacement Residual : 1.86168 10⁻⁷

Contact name : DpCi
Max Normal Load : 19.8462
Max Normal Stress : -223398.
Displacement : 0.000117288
Contact a-length : 0.0186812
Contact b-length : 0.00227148
Contact area : 0.00013331
Distance to Corner : -0.00212672
Effective Speed Factor : 2.659
Load-Life Factor : 10.7184

Expected Average Life : 5.01542 10⁷

Contact name : DiCi
Max Normal Load : 12.9879
Max Normal Stress : -193726.
Displacement : 0.0000882047
Contact a-length : 0.0162003
Contact b-length : 0.00196989
Contact area : 0.000100257
Distance to Corner: Dp : 0.0100497
Distance to Corner: Ds : 0.0100497
Effective Speed Factor : 2.659
Load-Life Factor : 16.3783

Expected Average Life : 2.73441 10⁸

Contact name : DsCo
Max Normal Load : 24.6503
Max Normal Stress : -240147.
Displacement : 0.000135555
Contact a-length : 0.0200833
Contact b-length : 0.00244223
Contact area : 0.000154089
Distance to Corner : -0.00352879
Effective Speed Factor : 2.659
Load-Life Factor : 8.62951

Expected Average Life : 2.10731 10⁷

=====

Ball number : 35
Ball angle : 10.
Ball position : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 32.1656
Residual Force Vector : {0.0505839, -0.00523249, 0.00683376}

Displacement Residual : 1.88994 10⁻⁷

Contact name : DpCi
Max Normal Load : 19.9226
Max Normal Stress : -223685.
Displacement : 0.00011759
Contact a-length : 0.0187052
Contact b-length : 0.0022744
Contact area : 0.000133653
Distance to Corner : -0.00215072
Effective Speed Factor : 2.659
Load-Life Factor : 10.6773

Expected Average Life : 4.93894 10⁷

Contact name : DiCi
Max Normal Load : 12.9838
Max Normal Stress : -193703.
Displacement : 0.0000881836
Contact a-length : 0.0161984
Contact b-length : 0.00196966
Contact area : 0.000100233
Distance to Corner: Dp : 0.0100516
Distance to Corner: Ds : 0.0100516
Effective Speed Factor : 2.659
Load-Life Factor : 16.3835

Expected Average Life : 2.73785 10⁸

Contact name : DsCo
Max Normal Load : 24.712
Max Normal Stress : -240347.
Displacement : 0.000135782
Contact a-length : 0.0201001
Contact b-length : 0.00244427
Contact area : 0.000154346
Distance to Corner : -0.00354555
Effective Speed Factor : 2.659
Load-Life Factor : 8.60796

Expected Average Life : 2.08634 10⁷

```
=====
Ball number      : 36
Ball angle       : 0.
Ball position    : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 39.8205
Residual Force Vector : {0.425074, 0.305519, -0.211831}
Displacement Residual : 2.26765 10-6
****
Contact name     : DpCo
Max Normal Load  : 17.9522
Max Normal Stress : -217458.
Displacement     : 0.000111144
Contact a-length : 0.0181853
Contact b-length : 0.00221134
Contact area     : 0.000126336
Distance to Corner : -0.00163082
Effective Speed Factor : 2.659
Load-Life Factor : 11.8492
Expected Average Life : 7.49103 107
****
Contact name     : DiCi
Max Normal Load  : 14.8001
Max Normal Stress : -200658.
Displacement     : 0.0000946302
Contact a-length : 0.01678
Contact b-length : 0.00204038
Contact area     : 0.000107561
Distance to Corner: Dp : 0.00946998
Distance to Corner: Ds : 0.00946998
Effective Speed Factor : 2.659
Load-Life Factor : 14.3729
Expected Average Life : 1.62167 108
****
Contact name     : DsCi
Max Normal Load  : 22.7025
Max Normal Stress : -233578.
Displacement     : 0.000128214
Contact a-length : 0.0195319
Contact b-length : 0.00237482
Contact area     : 0.000145722
Distance to Corner : -0.00297743
Effective Speed Factor : 2.659
Load-Life Factor : 9.36988
Expected Average Life : 2.929 107
```


=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.361843

Total Internal Loads (Fx,Fy,Fz)
Primary Disk : {-323.202, 55.5224, -409.088}
Intermediate Disk : {15.1257, -19.1926, -24.599}
Secondary Disk : {316.206, -41.3887, 438.939}

Total Axial Torque (Tz)
Primary Disk : 31.5624
Intermediate Disk : 1196.67
Secondary Disk : -1200.06

Torque Ratio: Ds/Dp : 38.0219
Torque Ratio: Di/Dp : 37.9143
Torque Ratio: Di/Ds : 0.997171

Torsional Stiffness (T/rad) : 190023.

Average Residual Force : {-0.225845, 0.140525, -0.14588}
-6

Average Displacement Residual : 1.86629 10

Dp Speed : 10.
Ds Speed : 0.27027
Speed Conversion Ratio : 37.
Effective N.D. Speed : 20.
Minimum Expected Average Life : 20.

hours : 4.93894 10⁷
years : 5638.06

Average Load-Life Factor: Dp : 11.7108
Average Load-Life Factor: Di : 15.2616
Average Load-Life Factor: Ds : 9.19041

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	: -223685.
At ball number	: 35
Maximum Compressive Contact Stress Di	: -200658.
At ball number	: 36
Maximum Compressive Contact Stress Ds	: -233578.
At ball number	: 36
Maximum Ball Deflection Dp	: 0.00011759
At ball number	: 35
Maximum Ball Deflection Di	: 0.0000946302
At ball number	: 36
Maximum Ball Deflection Ds	: 0.000135782
At ball number	: 35
Maximum Ball Contact Area Dp	: 0.000133653
At ball number	: 35
Maximum Ball Contact Area Di	: 0.000107561
At ball number	: 36
Maximum Ball Contact Area Ds	: 0.000154346
At ball number	: 35
Maximum Ball a-patch Dp	: 0.0187052
At ball number	: 35
Maximum Ball a-patch Di	: 0.01678
At ball number	: 36
Maximum Ball a-patch Ds	: 0.0201001
At ball number	: 35
Maximum Ball b-patch Dp	: 0.0022744
At ball number	: 35
Maximum Ball b-patch Di	: 0.00204038
At ball number	: 36
Maximum Ball b-patch Ds	: 0.00244427
At ball number	: 35
Minimum Distance to Dp Corner	: -0.00215072
At ball number	: 35
Minimum Distance to Di Corner: Dp	: 0.00946998
At ball number	: 36
Minimum Distance to Di Corner: Ds	: 0.00946998
At ball number	: 36
Minimum Distance to Ds Corner	: -0.00354555
At ball number	: 35

=====
=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 40 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter	= 0.15625
ConformingDiameter	= 0.1625
ConformingPercentage	= 52.
PrimaryFlankAngleDegrees	= 40.
IntermediateFlankAngleDegrees	= 0.
SecondaryFlankAngleDegrees	= 40.
PrimaryFractionBallDepth	= 0.3
SecondaryFractionBallDepth	= 0.3
ToleranceFraction	= 0.01
ContactToCornerDistance for Dp	= 0.0247607
ContactToCornerDistance for Ds	= 0.0247607

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

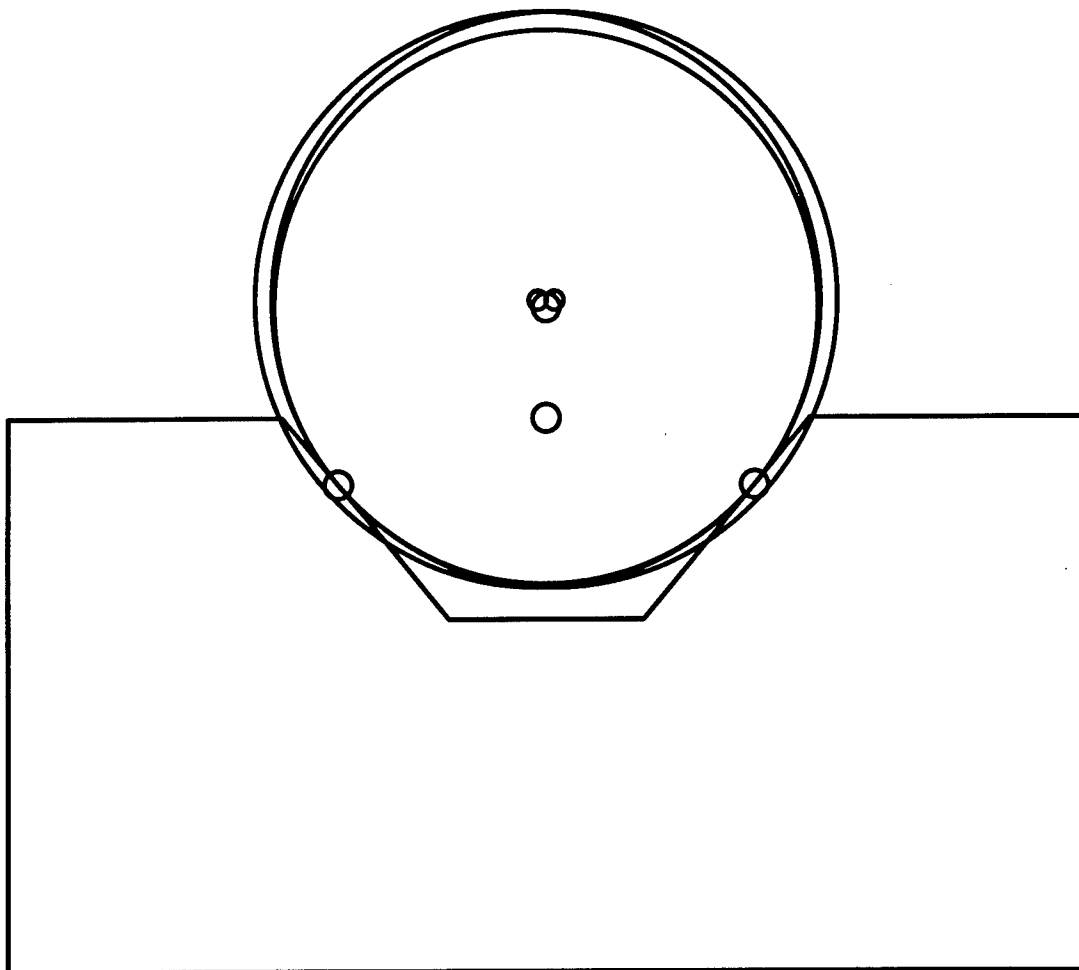
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition       = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta             = 1.
PrimaryAngleNumber            = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

===== Summary of Stress and Displacement Calculations =====

```

Calculated for kinematic solution : 6
Angular Deformation                 : 0.395194
Applied Torque                      : 1200.

```

```
=====
Ball number      : 1
Ball angle       : 350.
Ball position    : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.2375
Residual Force Vector : {0.503809, 0.29151, -0.14441}
Displacement Residual : 2.39583 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.8801
Max Normal Stress : -224625.
Displacement     : 0.000118592
Contact a-length : 0.0187847
Contact b-length : 0.00228422
Contact area     : 0.000134801
Distance to Corner : 0.00597596
Effective Speed Factor : 2.659
Load-Life Factor : 10.7002
Expected Average Life : 4.98132 107
****
Contact name     : DiCi
Max Normal Load  : 14.9633
Max Normal Stress : -201057.
Displacement     : 0.0000950073
Contact a-length : 0.0168134
Contact b-length : 0.00204444
Contact area     : 0.000107989
Distance to Corner: Dp : 0.00943658
Distance to Corner: Ds : 0.00943658
Effective Speed Factor : 2.659
Load-Life Factor : 14.2161
Expected Average Life : 1.55205 108
****
Contact name     : DsCi
Max Normal Load  : 24.1761
Max Normal Stress : -238811.
Displacement     : 0.000134022
Contact a-length : 0.0199695
Contact b-length : 0.00242802
Contact area     : 0.000152324
Distance to Corner : 0.00479119
Effective Speed Factor : 2.659
Load-Life Factor : 8.79877
Expected Average Life : 2.27756 107
```

=====

Ball number : 2
 Ball angle : 340.
 Ball position : {-0.640757, 2.39134, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.3348
 Residual Force Vector : {0.435179, 0.371096, -0.145469}

Displacement Residual : 2.35975 10⁻⁶

Contact name : DpCo
 Max Normal Load : 19.8138
 Max Normal Stress : -224371.
 Displacement : 0.000118324
 Contact a-length : 0.0187635
 Contact b-length : 0.00228164
 Contact area : 0.000134496
 Distance to Corner : 0.00599721
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.7359

Expected Average Life : 5.0483 10⁷

Contact name : DiCi
 Max Normal Load : 14.9524
 Max Normal Stress : -201048.
 Displacement : 0.0000949982
 Contact a-length : 0.0168126
 Contact b-length : 0.00204434
 Contact area : 0.000107979
 Distance to Corner: Dp : 0.00943738
 Distance to Corner: Ds : 0.00943738
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.2265

Expected Average Life : 1.55658 10⁸

Contact name : DsCi
 Max Normal Load : 24.1244
 Max Normal Stress : -238629.
 Displacement : 0.000133819
 Contact a-length : 0.0199543
 Contact b-length : 0.00242618
 Contact area : 0.000152093
 Distance to Corner : 0.00480638
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.81762

Expected Average Life : 2.29715 10⁷

=====

Ball number : 3
Ball angle : 330.
Ball position : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.4324
Residual Force Vector : {0.354572, 0.435769, -0.146485}
Displacement Residual : 2.32368 10⁻⁶

Contact name : DpCo
Max Normal Load : 19.7473
Max Normal Stress : -224115.
Displacement : 0.000118054
Contact a-length : 0.0187421
Contact b-length : 0.00227904
Contact area : 0.00013419
Distance to Corner : 0.00601858
Effective Speed Factor : 2.659
Load-Life Factor : 10.7721

7

Expected Average Life : 5.11662 10

Contact name : DiCi
Max Normal Load : 14.9413
Max Normal Stress : -201037.
Displacement : 0.0000949882
Contact a-length : 0.0168117
Contact b-length : 0.00204424
Contact area : 0.000107968
Distance to Corner: Dp : 0.00943827
Distance to Corner: Ds : 0.00943827
Effective Speed Factor : 2.659
Load-Life Factor : 14.237

8

Expected Average Life : 1.56121 10

Contact name : DsCi
Max Normal Load : 24.0725
Max Normal Stress : -238446.
Displacement : 0.000133614
Contact a-length : 0.019939
Contact b-length : 0.00242432
Contact area : 0.00015186
Distance to Corner : 0.00482167
Effective Speed Factor : 2.659
Load-Life Factor : 8.83665

7

Expected Average Life : 2.31705 10

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.5304
Residual Force Vector : {0.265063, 0.48385, -0.147457}

Displacement Residual : 2.28764 10⁻⁶

Contact name : DpCo
Max Normal Load : 19.6806
Max Normal Stress : -223858.
Displacement : 0.000117784
Contact a-length : 0.0187206
Contact b-length : 0.00227643
Contact area : 0.000133882
Distance to Corner : 0.00604008
Effective Speed Factor : 2.659
Load-Life Factor : 10.8086

Expected Average Life : 5.18632 10⁷

Contact name : DiCi
Max Normal Load : 14.93
Max Normal Stress : -201026.
Displacement : 0.0000949772
Contact a-length : 0.0168108
Contact b-length : 0.00204412
Contact area : 0.000107955
Distance to Corner: Dp : 0.00943924
Distance to Corner: Ds : 0.00943924
Effective Speed Factor : 2.659
Load-Life Factor : 14.2478

Expected Average Life : 1.56594 10⁸

Contact name : DsCi
Max Normal Load : 24.0202
Max Normal Stress : -238262.
Displacement : 0.000133408
Contact a-length : 0.0199236
Contact b-length : 0.00242245
Contact area : 0.000151626
Distance to Corner : 0.00483704
Effective Speed Factor : 2.659
Load-Life Factor : 8.85587

Expected Average Life : 2.33727 10⁷

=====

Ball number : 5
Ball angle : 310.
Ball position : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.6288
Residual Force Vector : {0.16994, 0.514271, -0.148384}

-6

Displacement Residual : 2.25163 10

Contact name : DpCo
Max Normal Load : 19.6138
Max Normal Stress : -223600.
Displacement : 0.000117512
Contact a-length : 0.018699
Contact b-length : 0.0022738
Contact area : 0.000133573
Distance to Corner : 0.0060617
Effective Speed Factor : 2.659
Load-Life Factor : 10.8454

7

Expected Average Life : 5.25743 10

Contact name : DiCi
Max Normal Load : 14.9185
Max Normal Stress : -201013.
Displacement : 0.0000949653
Contact a-length : 0.0168097
Contact b-length : 0.00204399
Contact area : 0.000107942
Distance to Corner: Dp : 0.00944029
Distance to Corner: Ds : 0.00944029
Effective Speed Factor : 2.659
Load-Life Factor : 14.2588

8

Expected Average Life : 1.57077 10

Contact name : DsCi
Max Normal Load : 23.9677
Max Normal Stress : -238077.
Displacement : 0.000133201
Contact a-length : 0.0199082
Contact b-length : 0.00242057
Contact area : 0.00015139
Distance to Corner : 0.00485251
Effective Speed Factor : 2.659
Load-Life Factor : 8.87527

7

Expected Average Life : 2.35782 10

```
=====
Ball number      : 6
Ball angle       : 300.
Ball position    : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.7277
Residual Force Vector : {0.0725791, 0.526594, -0.149265}
Displacement Residual : 2.21565 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.5467
Max Normal Stress : -223340.
Displacement     : 0.000117239
Contact a-length : 0.0186772
Contact b-length : 0.00227115
Contact area     : 0.000133263
Distance to Corner : 0.00608345
Effective Speed Factor : 2.659
Load-Life Factor : 10.8827
Expected Average Life : 5.32997 107
****
Contact name     : DiCi
Max Normal Load  : 14.9068
Max Normal Stress : -200999.
Displacement     : 0.0000949525
Contact a-length : 0.0168086
Contact b-length : 0.00204385
Contact area     : 0.000107927
Distance to Corner: Dp : 0.00944143
Distance to Corner: Ds : 0.00944143
Effective Speed Factor : 2.659
Load-Life Factor : 14.27
Expected Average Life : 1.5757 108
****
Contact name     : DsCi
Max Normal Load  : 23.9149
Max Normal Stress : -237891.
Displacement     : 0.000132992
Contact a-length : 0.0198926
Contact b-length : 0.00241868
Contact area     : 0.000151154
Distance to Corner : 0.00486807
Effective Speed Factor : 2.659
Load-Life Factor : 8.89487
Expected Average Life : 2.37871 107
```

```

=====
Ball number      : 7
Ball angle       : 290.
Ball position    : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 37.8269
Residual Force Vector : {-0.0236712, 0.521014, -0.150101}
Displacement Residual : 2.17969 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.4794
Max Normal Stress : -223078.
Displacement     : 0.000116964
Contact a-length : 0.0186554
Contact b-length : 0.00226849
Contact area     : 0.000132951
Distance to Corner : 0.00610533
Effective Speed Factor : 2.659
Load-Life Factor : 10.9203
Expected Average Life : 5.404 107
****
Contact name     : DiCi
Max Normal Load  : 14.8949
Max Normal Stress : -200985.
Displacement     : 0.0000949387
Contact a-length : 0.0168074
Contact b-length : 0.0020437
Contact area     : 0.000107911
Distance to Corner: Dp : 0.00944265
Distance to Corner: Ds : 0.00944265
Effective Speed Factor : 2.659
Load-Life Factor : 14.2814
Expected Average Life : 1.58075 108
****
Contact name     : DsCi
Max Normal Load  : 23.8619
Max Normal Stress : -237704.
Displacement     : 0.000132783
Contact a-length : 0.019877
Contact b-length : 0.00241677
Contact area     : 0.000150916
Distance to Corner : 0.00488373
Effective Speed Factor : 2.659
Load-Life Factor : 8.91465
Expected Average Life : 2.39994 107

```

=====

Ball number : 8
 Ball angle : 280.
 Ball position : {-2.32091, 0.621885, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 37.9266
 Residual Force Vector : {-0.115604, 0.498326, -0.150889}

Displacement Residual : 2.14377 10⁻⁶

Contact name : DpCo
 Max Normal Load : 19.4119
 Max Normal Stress : -222815.
 Displacement : 0.000116688
 Contact a-length : 0.0186333
 Contact b-length : 0.00226581
 Contact area : 0.000132637
 Distance to Corner : 0.00612733
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.9582

Expected Average Life : 5.47954 10⁷

Contact name : DiCi
 Max Normal Load : 14.8828
 Max Normal Stress : -200969.
 Displacement : 0.000094924
 Contact a-length : 0.016806
 Contact b-length : 0.00204355
 Contact area : 0.000107895
 Distance to Corner: Dp : 0.00944396
 Distance to Corner: Ds : 0.00944396
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.293

Expected Average Life : 1.5859 10⁸

Contact name : DsCi
 Max Normal Load : 23.8085
 Max Normal Stress : -237516.
 Displacement : 0.000132573
 Contact a-length : 0.0198612
 Contact b-length : 0.00241486
 Contact area : 0.000150677
 Distance to Corner : 0.00489948
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.93462

Expected Average Life : 2.42152 10⁷

=====

Ball number : 9
Ball angle : 270.
Ball position : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 38.0267
Residual Force Vector : {-0.200263, 0.459886, -0.151629}

-6
Displacement Residual : 2.10788 10

Contact name : DpCo
Max Normal Load : 19.3442
Max Normal Stress : -222551.
Displacement : 0.000116411
Contact a-length : 0.0186112
Contact b-length : 0.00226312
Contact area : 0.000132322
Distance to Corner : 0.00614947
Effective Speed Factor : 2.659
Load-Life Factor : 10.9966

7
Expected Average Life : 5.55663 10

Contact name : DiCi
Max Normal Load : 14.8705
Max Normal Stress : -200953.
Displacement : 0.0000949082
Contact a-length : 0.0168047
Contact b-length : 0.00204338
Contact area : 0.000107877
Distance to Corner: Dp : 0.00944535
Distance to Corner: Ds : 0.00944535
Effective Speed Factor : 2.659
Load-Life Factor : 14.3048

8
Expected Average Life : 1.59116 10

Contact name : DsCi
Max Normal Load : 23.7549
Max Normal Stress : -237326.
Displacement : 0.000132361
Contact a-length : 0.0198454
Contact b-length : 0.00241293
Contact area : 0.000150437
Distance to Corner : 0.00491532
Effective Speed Factor : 2.659
Load-Life Factor : 8.95479

7
Expected Average Life : 2.44346 10

```
=====
Ball number      : 10
Ball angle       : 260.
Ball position     : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 38.1272
Residual Force Vector : {-0.275033, 0.407548, -0.15232}
                                     -6
Displacement Residual : 2.07203 10
****
Contact name      : DpCo
Max Normal Load   : 19.2763
Max Normal Stress : -222284.
Displacement      : 0.000116133
Contact a-length  : 0.0185889
Contact b-length  : 0.00226042
Contact area      : 0.000132006
Distance to Corner : 0.00617173
Effective Speed Factor : 2.659
Load-Life Factor   : 11.0353
                                     7
Expected Average Life : 5.63531 10
****
Contact name      : DiCi
Max Normal Load   : 14.858
Max Normal Stress : -200935.
Displacement      : 0.0000948915
Contact a-length  : 0.0168032
Contact b-length  : 0.0020432
Contact area      : 0.000107858
Distance to Corner: Dp : 0.00944683
Distance to Corner: Ds : 0.00944683
Effective Speed Factor : 2.659
Load-Life Factor   : 14.3169
                                     8
Expected Average Life : 1.59653 10
****
Contact name      : DsCi
Max Normal Load   : 23.701
Max Normal Stress : -237136.
Displacement      : 0.000132149
Contact a-length  : 0.0198294
Contact b-length  : 0.00241099
Contact area      : 0.000150195
Distance to Corner : 0.00493126
Effective Speed Factor : 2.659
Load-Life Factor   : 8.97516
                                     7
Expected Average Life : 2.46577 10
```



```
=====
Ball number      : 11
Ball angle       : 250.
Ball position    : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.2281
Residual Force Vector : {-0.337724, 0.343581, -0.152961}
Displacement Residual : 2.03622 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.2083
Max Normal Stress : -222017.
Displacement     : 0.000115853
Contact a-length : 0.0185666
Contact b-length : 0.00225769
Contact area     : 0.000131688
Distance to Corner : 0.00619413
Effective Speed Factor : 2.659
Load-Life Factor : 11.0744
Expected Average Life : 5.71562 107
****
Contact name     : DiCi
Max Normal Load  : 14.8453
Max Normal Stress : -200916.
Displacement     : 0.0000948738
Contact a-length : 0.0168016
Contact b-length : 0.00204301
Contact area     : 0.000107838
Distance to Corner: Dp : 0.00944839
Distance to Corner: Ds : 0.00944839
Effective Speed Factor : 2.659
Load-Life Factor : 14.3292
Expected Average Life : 1.60202 108
****
Contact name     : DsCi
Max Normal Load  : 23.6468
Max Normal Stress : -236944.
Displacement     : 0.000131935
Contact a-length : 0.0198134
Contact b-length : 0.00240904
Contact area     : 0.000149952
Distance to Corner : 0.00494729
Effective Speed Factor : 2.659
Load-Life Factor : 8.99573
Expected Average Life : 2.48845 107
```

```
=====
Ball number      : 12
Ball angle       : 240.
Ball position    : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.3294
Residual Force Vector : {-0.386636, 0.270583, -0.153551}
Displacement Residual : 2.00045 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.14
Max Normal Stress : -221747.
Displacement     : 0.000115572
Contact a-length : 0.018544
Contact b-length : 0.00225495
Contact area     : 0.000131369
Distance to Corner : 0.00621665
Effective Speed Factor : 2.659
Load-Life Factor : 11.1139
Expected Average Life : 5.7976 107
****
Contact name     : DiCi
Max Normal Load  : 14.8323
Max Normal Stress : -200896.
Displacement     : 0.0000948551
Contact a-length : 0.0168
Contact b-length : 0.0020428
Contact area     : 0.000107816
Distance to Corner: Dp : 0.00945005
Distance to Corner: Ds : 0.00945005
Effective Speed Factor : 2.659
Load-Life Factor : 14.3417
Expected Average Life : 1.60762 108
****
Contact name     : DsCi
Max Normal Load  : 23.5923
Max Normal Stress : -236751.
Displacement     : 0.000131721
Contact a-length : 0.0197973
Contact b-length : 0.00240708
Contact area     : 0.000149708
Distance to Corner : 0.00496342
Effective Speed Factor : 2.659
Load-Life Factor : 9.0165
Expected Average Life : 2.51151 107
```

```
=====
Ball number      : 13
Ball angle       : 230.
Ball position    : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.4311
Residual Force Vector : {-0.420598, 0.191376, -0.15409}
Displacement Residual : 1.96472 10-6
****
Contact name     : DpCo
Max Normal Load  : 19.0715
Max Normal Stress : -221476.
Displacement     : 0.00011529
Contact a-length : 0.0185214
Contact b-length : 0.0022522
Contact area     : 0.000131048
Distance to Corner : 0.00623931
Effective Speed Factor : 2.659
Load-Life Factor : 11.1538
Expected Average Life : 5.8813 107
****
Contact name     : DiCi
Max Normal Load  : 14.8191
Max Normal Stress : -200875.
Displacement     : 0.0000948354
Contact a-length : 0.0167982
Contact b-length : 0.00204259
Contact area     : 0.000107794
Distance to Corner: Dp : 0.0094518
Distance to Corner: Ds : 0.0094518
Effective Speed Factor : 2.659
Load-Life Factor : 14.3544
Expected Average Life : 1.61333 108
****
Contact name     : DsCi
Max Normal Load  : 23.5375
Max Normal Stress : -236557.
Displacement     : 0.000131505
Contact a-length : 0.019781
Contact b-length : 0.00240511
Contact area     : 0.000149463
Distance to Corner : 0.00497965
Effective Speed Factor : 2.659
Load-Life Factor : 9.03748
Expected Average Life : 2.53497 107
```

=====

Ball number : 14
Ball angle : 220.
Ball position : {-1.64746, -1.64746, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 38.5333
Residual Force Vector : {-0.438999, 0.108905, -0.154576}
Displacement Residual : 1.92904 10⁻⁶

Contact name : DpCo
Max Normal Load : 19.0029
Max Normal Stress : -221204.
Displacement : 0.000115007
Contact a-length : 0.0184986
Contact b-length : 0.00224943
Contact area : 0.000130725
Distance to Corner : 0.0062621
Effective Speed Factor : 2.659
Load-Life Factor : 11.1941

Expected Average Life : 5.96675 10⁷

Contact name : DiCi
Max Normal Load : 14.8058
Max Normal Stress : -200853.
Displacement : 0.0000948147
Contact a-length : 0.0167964
Contact b-length : 0.00204237
Contact area : 0.00010777
Distance to Corner: Dp : 0.00945363
Distance to Corner: Ds : 0.00945363
Effective Speed Factor : 2.659
Load-Life Factor : 14.3674

Expected Average Life : 1.61917 10⁸

Contact name : DsCi
Max Normal Load : 23.4825
Max Normal Stress : -236362.
Displacement : 0.000131288
Contact a-length : 0.0197647
Contact b-length : 0.00240312
Contact area : 0.000149216
Distance to Corner : 0.00499597
Effective Speed Factor : 2.659
Load-Life Factor : 9.05866

Expected Average Life : 2.55882 10⁷

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 38.6358
Residual Force Vector : {-0.441789, 0.0261266, -0.155009}
Displacement Residual : 1.8934 10⁻⁶

Contact name : DpCo
Max Normal Load : 18.9341
Max Normal Stress : -220930.
Displacement : 0.000114722
Contact a-length : 0.0184757
Contact b-length : 0.00224664
Contact area : 0.000130402
Distance to Corner : 0.00628502
Effective Speed Factor : 2.659
Load-Life Factor : 11.2348

Expected Average Life : 6.054 10⁷

Contact name : DiCi
Max Normal Load : 14.7922
Max Normal Stress : -200830.
Displacement : 0.0000947929
Contact a-length : 0.0167944
Contact b-length : 0.00204213
Contact area : 0.000107746
Distance to Corner: Dp : 0.00945556
Distance to Corner: Ds : 0.00945556
Effective Speed Factor : 2.659
Load-Life Factor : 14.3806

Expected Average Life : 1.62513 10⁸

Contact name : DsCi
Max Normal Load : 23.4272
Max Normal Stress : -236165.
Displacement : 0.00013107
Contact a-length : 0.0197483
Contact b-length : 0.00240113
Contact area : 0.000148969
Distance to Corner : 0.0050124
Effective Speed Factor : 2.659
Load-Life Factor : 9.08006

Expected Average Life : 2.58308 10⁷

```

=====
Ball number      : 16
Ball angle       : 200.
Ball position    : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.7388
Residual Force Vector : {-0.429466, -0.0540916, -0.155388}
                                     -6
Displacement Residual : 1.85782 10
****
Contact name      : DpCo
Max Normal Load   : 18.865
Max Normal Stress : -220654.
Displacement      : 0.000114436
Contact a-length  : 0.0184526
Contact b-length  : 0.00224383
Contact area      : 0.000130076
Distance to Corner : 0.00630807
Effective Speed Factor : 2.659
Load-Life Factor  : 11.2759
                                     7
Expected Average Life : 6.1431 10
****
Contact name      : DiCi
Max Normal Load   : 14.7784
Max Normal Stress : -200806.
Displacement      : 0.0000947701
Contact a-length  : 0.0167924
Contact b-length  : 0.00204189
Contact area      : 0.00010772
Distance to Corner: Dp : 0.00945758
Distance to Corner: Ds : 0.00945758
Effective Speed Factor : 2.659
Load-Life Factor  : 14.394
                                     8
Expected Average Life : 1.63121 10
****
Contact name      : DsCi
Max Normal Load   : 23.3716
Max Normal Stress : -235968.
Displacement      : 0.00013085
Contact a-length  : 0.0197318
Contact b-length  : 0.00239912
Contact area      : 0.000148719
Distance to Corner : 0.00502892
Effective Speed Factor : 2.659
Load-Life Factor  : 9.10166
                                     7
Expected Average Life : 2.60775 10

```

```
=====
Ball number      : 17
Ball angle       : 190.
Ball position    : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 38.8422
Residual Force Vector : {-0.403037, -0.129072, -0.155712}
                                     -6
Displacement Residual : 1.82228 10
****
Contact name      : DpCo
Max Normal Load   : 18.7958
Max Normal Stress : -220377.
Displacement      : 0.000114148
Contact a-length  : 0.0184294
Contact b-length  : 0.00224101
Contact area      : 0.00012975
Distance to Corner : 0.00633126
Effective Speed Factor : 2.659
Load-Life Factor  : 11.3174
                                     7
Expected Average Life : 6.23409 10
****
Contact name      : DiCi
Max Normal Load   : 14.7644
Max Normal Stress : -200781.
Displacement      : 0.0000947462
Contact a-length  : 0.0167903
Contact b-length  : 0.00204163
Contact area      : 0.000107693
Distance to Corner: Dp : 0.0094597
Distance to Corner: Ds : 0.0094597
Effective Speed Factor : 2.659
Load-Life Factor  : 14.4077
                                     8
Expected Average Life : 1.63741 10
****
Contact name      : DsCi
Max Normal Load   : 23.3156
Max Normal Stress : -235769.
Displacement      : 0.00013063
Contact a-length  : 0.0197151
Contact b-length  : 0.0023971
Contact area      : 0.000148469
Distance to Corner : 0.00504553
Effective Speed Factor : 2.659
Load-Life Factor  : 9.12349
                                     7
Expected Average Life : 2.63286 10
```

```
=====
Ball number      : 18
Ball angle       : 180.
Ball position    : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.7656
Residual Force Vector : {-0.0739164, -0.00322451, 0.010387}
Displacement Residual : 2.78822 10
****
Contact name     : DpCi
Max Normal Load  : 20.5737
Max Normal Stress : -226110.
Displacement     : 0.000120154
Contact a-length : 0.0189081
Contact b-length : 0.00229907
Contact area     : 0.000136568
Distance to Corner : 0.00585262
Effective Speed Factor : 2.659
Load-Life Factor : 10.3394
Expected Average Life : 4.34281 10
****
Contact name     : DiCi
Max Normal Load  : 13.0052
Max Normal Stress : -193714.
Displacement     : 0.0000881938
Contact a-length : 0.0161993
Contact b-length : 0.00196977
Contact area     : 0.000100245
Distance to Corner: Dp : 0.0100507
Distance to Corner: Ds : 0.0100507
Effective Speed Factor : 2.659
Load-Life Factor : 16.3566
Expected Average Life : 2.71989 10
****
Contact name     : DsCo
Max Normal Load  : 25.2102
Max Normal Stress : -241976.
Displacement     : 0.000137629
Contact a-length : 0.0202363
Contact b-length : 0.00246084
Contact area     : 0.000156446
Distance to Corner : 0.00452437
Effective Speed Factor : 2.659
Load-Life Factor : 8.43785
Expected Average Life : 1.92624 10
```


=====

Ball number : 19
Ball angle : 170.
Ball position : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.66
Residual Force Vector : {-0.0727338, -0.0159131, 0.0102101}

-7
Displacement Residual : 2.81512 10

Contact name : DpCi
Max Normal Load : 20.652
Max Normal Stress : -226398.
Displacement : 0.00012046
Contact a-length : 0.0189321
Contact b-length : 0.00230199
Contact area : 0.000136915
Distance to Corner : 0.00582859
Effective Speed Factor : 2.659
Load-Life Factor : 10.3002

7
Expected Average Life : 4.27731 10

Contact name : DiCi
Max Normal Load : 13.0017
Max Normal Stress : -193694.
Displacement : 0.0000881756
Contact a-length : 0.0161976
Contact b-length : 0.00196957
Contact area : 0.000100224
Distance to Corner: Dp : 0.0100524
Distance to Corner: Ds : 0.0100524
Effective Speed Factor : 2.659
Load-Life Factor : 16.3609

8
Expected Average Life : 2.7228 10

Contact name : DsCo
Max Normal Load : 25.2747
Max Normal Stress : -242182.
Displacement : 0.000137863
Contact a-length : 0.0202535
Contact b-length : 0.00246293
Contact area : 0.000156712
Distance to Corner : 0.00450714
Effective Speed Factor : 2.659
Load-Life Factor : 8.41631

7
Expected Average Life : 1.90665 10

=====

Ball number : 20
Ball angle : 160.
Ball position : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.5549
Residual Force Vector : {-0.0693725, -0.0282938, 0.0100355}

-7
Displacement Residual : 2.8419 10

Contact name : DpCi
Max Normal Load : 20.73
Max Normal Stress : -226683.
Displacement : 0.000120764
Contact a-length : 0.018956
Contact b-length : 0.00230489
Contact area : 0.000137261
Distance to Corner : 0.0058047
Effective Speed Factor : 2.659
Load-Life Factor : 10.2614

7
Expected Average Life : 4.21326 10

Contact name : DiCi
Max Normal Load : 12.998
Max Normal Stress : -193673.
Displacement : 0.0000881562
Contact a-length : 0.0161959
Contact b-length : 0.00196935
Contact area : 0.000100202
Distance to Corner: Dp : 0.0100541
Distance to Corner: Ds : 0.0100541
Effective Speed Factor : 2.659
Load-Life Factor : 16.3656

8
Expected Average Life : 2.72593 10

Contact name : DsCo
Max Normal Load : 25.3389
Max Normal Stress : -242387.
Displacement : 0.000138096
Contact a-length : 0.0202707
Contact b-length : 0.00246502
Contact area : 0.000156978
Distance to Corner : 0.00449002
Effective Speed Factor : 2.659
Load-Life Factor : 8.39499

7
Expected Average Life : 1.8874 10

```
=====
Ball number      : 21
Ball angle       : 150.
Ball position    : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.4502
Residual Force Vector : {-0.063903, -0.0399921, 0.0098633}
Displacement Residual : 2.86857 10-7
****
Contact name     : DpCi
Max Normal Load  : 20.8078
Max Normal Stress : -226967.
Displacement     : 0.000121067
Contact a-length : 0.0189797
Contact b-length : 0.00230778
Contact area     : 0.000137605
Distance to Corner : 0.00578095
Effective Speed Factor : 2.659
Load-Life Factor : 10.2231
Expected Average Life : 4.15062 107
****
Contact name     : DiCi
Max Normal Load  : 12.994
Max Normal Stress : -193650.
Displacement     : 0.0000881358
Contact a-length : 0.016194
Contact b-length : 0.00196912
Contact area     : 0.000100179
Distance to Corner: Dp : 0.010056
Distance to Corner: Ds : 0.010056
Effective Speed Factor : 2.659
Load-Life Factor : 16.3706
Expected Average Life : 2.72926 108
****
Contact name     : DsCo
Max Normal Load  : 25.4028
Max Normal Stress : -242590.
Displacement     : 0.000138328
Contact a-length : 0.0202877
Contact b-length : 0.00246708
Contact area     : 0.000157241
Distance to Corner : 0.00447301
Effective Speed Factor : 2.659
Load-Life Factor : 8.37387
Expected Average Life : 1.86848 107
```

```
=====
Ball number      : 22
Ball angle       : 140.
Ball position    : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.346
Residual Force Vector : {-0.0564603, -0.0506487, 0.00969339}
                                     -7
Displacement Residual : 2.8951 10
****
Contact name     : DpCi
Max Normal Load  : 20.8853
Max Normal Stress : -227250.
Displacement     : 0.000121368
Contact a-length : 0.0190033
Contact b-length : 0.00231065
Contact area     : 0.000137948
Distance to Corner : 0.00575735
Effective Speed Factor : 2.659
Load-Life Factor : 10.1852
                                     7
Expected Average Life : 4.08936 10
****
Contact name     : DiCi
Max Normal Load  : 12.9898
Max Normal Stress : -193626.
Displacement     : 0.0000881143
Contact a-length : 0.016192
Contact b-length : 0.00196888
Contact area     : 0.000100154
Distance to Corner: Dp : 0.010058
Distance to Corner: Ds : 0.010058
Effective Speed Factor : 2.659
Load-Life Factor : 16.3759
                                     8
Expected Average Life : 2.7328 10
****
Contact name     : DsCo
Max Normal Load  : 25.4665
Max Normal Stress : -242793.
Displacement     : 0.000138559
Contact a-length : 0.0203046
Contact b-length : 0.00246914
Contact area     : 0.000157503
Distance to Corner : 0.0044561
Effective Speed Factor : 2.659
Load-Life Factor : 8.35295
                                     7
Expected Average Life : 1.84988 10
```

```
=====
Ball number      : 23
Ball angle       : 130.
Ball position    : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.2421
Residual Force Vector : {-0.0472407, -0.0599305, 0.00952573}
Displacement Residual : 2.92152 10-7
****
Contact name     : DpCi
Max Normal Load  : 20.9625
Max Normal Stress : -227530.
Displacement     : 0.000121668
Contact a-length : 0.0190268
Contact b-length : 0.0023135
Contact area     : 0.000138288
Distance to Corner : 0.00573389
Effective Speed Factor : 2.659
Load-Life Factor : 10.1476
Expected Average Life : 4.02944 107
****
Contact name     : DiCi
Max Normal Load  : 12.9853
Max Normal Stress : -193602.
Displacement     : 0.0000880917
Contact a-length : 0.0161899
Contact b-length : 0.00196863
Contact area     : 0.000100129
Distance to Corner: Dp : 0.0100601
Distance to Corner: Ds : 0.0100601
Effective Speed Factor : 2.659
Load-Life Factor : 16.3816
Expected Average Life : 2.73656 108
****
Contact name     : DsCo
Max Normal Load  : 25.5298
Max Normal Stress : -242993.
Displacement     : 0.000138788
Contact a-length : 0.0203214
Contact b-length : 0.00247118
Contact area     : 0.000157764
Distance to Corner : 0.00443931
Effective Speed Factor : 2.659
Load-Life Factor : 8.33224
Expected Average Life : 1.8316 107
```

=====

Ball number : 24
Ball angle : 120.
Ball position : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.1387
Residual Force Vector : {-0.0364967, -0.0675411, 0.00936028}

-7
Displacement Residual : 2.94781 10

Contact name : DpCi
Max Normal Load : 21.0394
Max Normal Stress : -227809.
Displacement : 0.000121966
Contact a-length : 0.0190501
Contact b-length : 0.00231634
Contact area : 0.000138627
Distance to Corner : 0.00571057
Effective Speed Factor : 2.659
Load-Life Factor : 10.1105

7
Expected Average Life : 3.97082 10

Contact name : DiCi
Max Normal Load : 12.9806
Max Normal Stress : -193576.
Displacement : 0.000088068
Contact a-length : 0.0161878
Contact b-length : 0.00196836
Contact area : 0.000100102
Distance to Corner: Dp : 0.0100622
Distance to Corner: Ds : 0.0100622
Effective Speed Factor : 2.659
Load-Life Factor : 16.3875

8
Expected Average Life : 2.74051 10

Contact name : DsCo
Max Normal Load : 25.5928
Max Normal Stress : -243193.
Displacement : 0.000139016
Contact a-length : 0.0203381
Contact b-length : 0.00247321
Contact area : 0.000158023
Distance to Corner : 0.00442262
Effective Speed Factor : 2.659
Load-Life Factor : 8.31172

7
Expected Average Life : 1.81362 10

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.0357
Residual Force Vector : {-0.0245303, -0.0732304, 0.00919699}

-7
Displacement Residual : 2.97397 10

Contact name : DpCi
Max Normal Load : 21.1161
Max Normal Stress : -228086.
Displacement : 0.000122263
Contact a-length : 0.0190733
Contact b-length : 0.00231916
Contact area : 0.000138965
Distance to Corner : 0.00568739
Effective Speed Factor : 2.659
Load-Life Factor : 10.0738

7
Expected Average Life : 3.91346 10

Contact name : DiCi
Max Normal Load : 12.9757
Max Normal Stress : -193548.
Displacement : 0.0000880433
Contact a-length : 0.0161855
Contact b-length : 0.00196809
Contact area : 0.000100074
Distance to Corner: Dp : 0.0100645
Distance to Corner: Ds : 0.0100645
Effective Speed Factor : 2.659
Load-Life Factor : 16.3937

8
Expected Average Life : 2.74467 10

Contact name : DsCo
Max Normal Load : 25.6555
Max Normal Stress : -243391.
Displacement : 0.000139243
Contact a-length : 0.0203546
Contact b-length : 0.00247523
Contact area : 0.000158281
Distance to Corner : 0.00440603
Effective Speed Factor : 2.659
Load-Life Factor : 8.2914

7
Expected Average Life : 1.79596 10

=====

Ball number : 26
 Ball angle : 100.
 Ball position : {2.29743, -0.615594, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 30.9332
 Residual Force Vector : {-0.0116846, -0.0768026, 0.00903583}
 Displacement Residual : 2.99999 10⁻⁷

Contact name : DpCi
 Max Normal Load : 21.1925
 Max Normal Stress : -228362.
 Displacement : 0.000122559
 Contact a-length : 0.0190963
 Contact b-length : 0.00232196
 Contact area : 0.000139301
 Distance to Corner : 0.00566436
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.0375

Expected Average Life : 3.85735 10⁷

Contact name : DiCi
 Max Normal Load : 12.9706
 Max Normal Stress : -193520.
 Displacement : 0.0000880175
 Contact a-length : 0.0161831
 Contact b-length : 0.0019678
 Contact area : 0.000100044
 Distance to Corner: Dp : 0.0100669
 Distance to Corner: Ds : 0.0100669
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.4002

Expected Average Life : 2.74904 10⁸

Contact name : DsCo
 Max Normal Load : 25.7179
 Max Normal Stress : -243588.
 Displacement : 0.000139469
 Contact a-length : 0.0203711
 Contact b-length : 0.00247723
 Contact area : 0.000158537
 Distance to Corner : 0.00438956
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.27128

Expected Average Life : 1.77858 10⁷

=====

Ball number : 27
 Ball angle : 90.
 Ball position : {2.38153, -0.208357, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 30.8311
 Residual Force Vector : {0.00166613, -0.0781234, 0.00887676}
 Displacement Residual : 3.02589 10⁻⁷

Contact name : DpCi
 Max Normal Load : 21.2686
 Max Normal Stress : -228636.
 Displacement : 0.000122853
 Contact a-length : 0.0191192
 Contact b-length : 0.00232474
 Contact area : 0.000139635
 Distance to Corner : 0.00564146
 Effective Speed Factor : 2.659
 Load-Life Factor : 10.0016

Expected Average Life : 3.80243 10⁷

Contact name : DiCi
 Max Normal Load : 12.9652
 Max Normal Stress : -193491.
 Displacement : 0.0000879907
 Contact a-length : 0.0161806
 Contact b-length : 0.0019675
 Contact area : 0.000100014
 Distance to Corner: Dp : 0.0100694
 Distance to Corner: Ds : 0.0100694
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.407

Expected Average Life : 2.75361 10⁸

Contact name : DsCo
 Max Normal Load : 25.78
 Max Normal Stress : -243784.
 Displacement : 0.000139693
 Contact a-length : 0.0203875
 Contact b-length : 0.00247922
 Contact area : 0.000158792
 Distance to Corner : 0.00437318
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.25135

Expected Average Life : 1.7615 10⁷

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.7294
Residual Force Vector : {0.0151273, -0.0771244, 0.00871974}

Displacement Residual : 3.05165 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.3444
Max Normal Stress : -228908.
Displacement : 0.000123145
Contact a-length : 0.019142
Contact b-length : 0.00232751
Contact area : 0.000139968
Distance to Corner : 0.00561871
Effective Speed Factor : 2.659
Load-Life Factor : 9.96607

Expected Average Life : 3.74869 10⁷

Contact name : DiCi
Max Normal Load : 12.9596
Max Normal Stress : -193460.
Displacement : 0.0000879629
Contact a-length : 0.0161781
Contact b-length : 0.00196719
Contact area : 0.0000999823
Distance to Corner: Dp : 0.0100719
Distance to Corner: Ds : 0.0100719
Effective Speed Factor : 2.659
Load-Life Factor : 16.4141

Expected Average Life : 2.75838 10⁸

Contact name : DsCo
Max Normal Load : 25.8418
Max Normal Stress : -243979.
Displacement : 0.000139916
Contact a-length : 0.0204038
Contact b-length : 0.0024812
Contact area : 0.000159046
Distance to Corner : 0.00435692
Effective Speed Factor : 2.659
Load-Life Factor : 8.23161

Expected Average Life : 1.74471 10⁷

=====

Ball number : 29
Ball angle : 70.
Ball position : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.6281
Residual Force Vector : {0.0282959, -0.0738064, 0.00856473}

Displacement Residual : 3.07727 10⁻⁷

Contact name : DpCi
Max Normal Load : 21.42
Max Normal Stress : -229178.
Displacement : 0.000123436
Contact a-length : 0.0191646
Contact b-length : 0.00233026
Contact area : 0.000140298
Distance to Corner : 0.00559609
Effective Speed Factor : 2.659
Load-Life Factor : 9.93092

Expected Average Life : 3.69608 10⁷

Contact name : DiCi
Max Normal Load : 12.9537
Max Normal Stress : -193428.
Displacement : 0.000087934
Contact a-length : 0.0161754
Contact b-length : 0.00196687
Contact area : 0.0000999496
Distance to Corner: Dp : 0.0100746
Distance to Corner: Ds : 0.0100746
Effective Speed Factor : 2.659
Load-Life Factor : 16.4215

Expected Average Life : 2.76335 10⁸

Contact name : DsCo
Max Normal Load : 25.9034
Max Normal Stress : -244172.
Displacement : 0.000140138
Contact a-length : 0.0204199
Contact b-length : 0.00248317
Contact area : 0.000159298
Distance to Corner : 0.00434075
Effective Speed Factor : 2.659
Load-Life Factor : 8.21206

Expected Average Life : 1.72819 10⁷

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.5272
Residual Force Vector : {0.0407723, -0.0682405, 0.00841171}

-7
Displacement Residual : 3.10275 10

Contact name : DpCi
Max Normal Load : 21.4952
Max Normal Stress : -229447.
Displacement : 0.000123726
Contact a-length : 0.0191871
Contact b-length : 0.00233299
Contact area : 0.000140628
Distance to Corner : 0.00557361
Effective Speed Factor : 2.659
Load-Life Factor : 9.89615

7
Expected Average Life : 3.64459 10

Contact name : DiCi
Max Normal Load : 12.9477
Max Normal Stress : -193396.
Displacement : 0.0000879042
Contact a-length : 0.0161727
Contact b-length : 0.00196653
Contact area : 0.0000999157
Distance to Corner: Dp : 0.0100773
Distance to Corner: Ds : 0.0100773
Effective Speed Factor : 2.659
Load-Life Factor : 16.4292

8
Expected Average Life : 2.76852 10

Contact name : DsCo
Max Normal Load : 25.9646
Max Normal Stress : -244364.
Displacement : 0.000140358
Contact a-length : 0.020436
Contact b-length : 0.00248512
Contact area : 0.000159549
Distance to Corner : 0.00432469
Effective Speed Factor : 2.659
Load-Life Factor : 8.19269

7
Expected Average Life : 1.71195 10

```
=====
Ball number      : 31
Ball angle       : 50.
Ball position    : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 30.4268
Residual Force Vector : {0.0521727, -0.0605664, 0.00826064}
Displacement Residual : 3.12809 10-7
****
Contact name     : DpCi
Max Normal Load  : 21.5702
Max Normal Stress : -229714.
Displacement     : 0.000124014
Contact a-length : 0.0192094
Contact b-length : 0.0023357
Contact area     : 0.000140955
Distance to Corner : 0.00555127
Effective Speed Factor : 2.659
Load-Life Factor : 9.86175
Expected Average Life : 3.59418 107
****
Contact name     : DiCi
Max Normal Load  : 12.9414
Max Normal Stress : -193362.
Displacement     : 0.0000878734
Contact a-length : 0.0161699
Contact b-length : 0.00196619
Contact area     : 0.0000998806
Distance to Corner: Dp : 0.0100801
Distance to Corner: Ds : 0.0100801
Effective Speed Factor : 2.659
Load-Life Factor : 16.4371
Expected Average Life : 2.77389 108
****
Contact name     : DsCo
Max Normal Load  : 26.0255
Max Normal Stress : -244555.
Displacement     : 0.000140577
Contact a-length : 0.0204519
Contact b-length : 0.00248706
Contact area     : 0.000159798
Distance to Corner : 0.00430873
Effective Speed Factor : 2.659
Load-Life Factor : 8.17351
Expected Average Life : 1.69597 107
```

=====

Ball number : 32
Ball angle : 40.
Ball position : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 30.3268
Residual Force Vector : {0.0621409, -0.0509896, 0.00811149}

-7
Displacement Residual : 3.15328 10

Contact name : DpCi
Max Normal Load : 21.6449
Max Normal Stress : -229980.
Displacement : 0.000124301
Contact a-length : 0.0192316
Contact b-length : 0.0023384
Contact area : 0.000141281
Distance to Corner : 0.00552907
Effective Speed Factor : 2.659
Load-Life Factor : 9.82772

7
Expected Average Life : 3.54482 10

Contact name : DiCi
Max Normal Load : 12.9349
Max Normal Stress : -193327.
Displacement : 0.0000878416
Contact a-length : 0.0161669
Contact b-length : 0.00196583
Contact area : 0.0000998445
Distance to Corner: Dp : 0.0100831
Distance to Corner: Ds : 0.0100831
Effective Speed Factor : 2.659
Load-Life Factor : 16.4454

8
Expected Average Life : 2.77946 10

Contact name : DsCo
Max Normal Load : 26.0862
Max Normal Stress : -244744.
Displacement : 0.000140796
Contact a-length : 0.0204678
Contact b-length : 0.00248899
Contact area : 0.000160046
Distance to Corner : 0.00429288
Effective Speed Factor : 2.659
Load-Life Factor : 8.15451

7
Expected Average Life : 1.68026 10

```
=====
Ball number      : 33
Ball angle       : 30.
Ball position    : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 30.2272
Residual Force Vector : {0.0703598, -0.0397757, 0.00796423}
Displacement Residual : 3.17833 10-7
****
Contact name     : DpCi
Max Normal Load  : 21.7193
Max Normal Stress : -230244.
Displacement     : 0.000124587
Contact a-length : 0.0192537
Contact b-length : 0.00234109
Contact area     : 0.000141606
Distance to Corner : 0.005507
Effective Speed Factor : 2.659
Load-Life Factor : 9.79405
Expected Average Life : 3.49649 107
****
Contact name     : DiCi
Max Normal Load  : 12.9282
Max Normal Stress : -193291.
Displacement     : 0.0000878089
Contact a-length : 0.0161639
Contact b-length : 0.00196547
Contact area     : 0.0000998073
Distance to Corner: Dp : 0.0100861
Distance to Corner: Ds : 0.0100861
Effective Speed Factor : 2.659
Load-Life Factor : 16.4539
Expected Average Life : 2.78522 108
****
Contact name     : DsCo
Max Normal Load  : 26.1465
Max Normal Stress : -244933.
Displacement     : 0.000141012
Contact a-length : 0.0204836
Contact b-length : 0.00249091
Contact area     : 0.000160292
Distance to Corner : 0.00427712
Effective Speed Factor : 2.659
Load-Life Factor : 8.13569
Expected Average Life : 1.6648 107
```

```
=====
Ball number      : 34
Ball angle       : 20.
Ball position    : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 30.128
Residual Force Vector : {0.0765608, -0.027243, 0.00781883}
Displacement Residual : 3.20323 10-7
****
Contact name     : DpCi
Max Normal Load  : 21.7934
Max Normal Stress : -230506.
Displacement     : 0.000124871
Contact a-length : 0.0192756
Contact b-length : 0.00234375
Contact area     : 0.000141929
Distance to Corner : 0.00548507
Effective Speed Factor : 2.659
Load-Life Factor : 9.76074
Expected Average Life : 3.44916 107
****
Contact name     : DiCi
Max Normal Load  : 12.9213
Max Normal Stress : -193254.
Displacement     : 0.0000877752
Contact a-length : 0.0161608
Contact b-length : 0.00196509
Contact area     : 0.000099769
Distance to Corner: Dp : 0.0100892
Distance to Corner: Ds : 0.0100892
Effective Speed Factor : 2.659
Load-Life Factor : 16.4627
Expected Average Life : 2.79118 108
****
Contact name     : DsCo
Max Normal Load  : 26.2066
Max Normal Stress : -245120.
Displacement     : 0.000141228
Contact a-length : 0.0204992
Contact b-length : 0.00249281
Contact area     : 0.000160537
Distance to Corner : 0.00426147
Effective Speed Factor : 2.659
Load-Life Factor : 8.11705
Expected Average Life : 1.64959 107
```



```
=====
Ball number      : 35
Ball angle       : 10.
Ball position    : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 30.0293
Residual Force Vector : {0.0805337, -0.0137539, 0.00767527}
Displacement Residual : 3.22798 10-7
****
Contact name     : DpCi
Max Normal Load  : 21.8673
Max Normal Stress : -230767.
Displacement     : 0.000125153
Contact a-length : 0.0192974
Contact b-length : 0.0023464
Contact area     : 0.00014225
Distance to Corner : 0.00546327
Effective Speed Factor : 2.659
Load-Life Factor : 9.72778
Expected Average Life : 3.40281 107
****
Contact name     : DiCi
Max Normal Load  : 12.9142
Max Normal Stress : -193215.
Displacement     : 0.0000877406
Contact a-length : 0.0161576
Contact b-length : 0.0019647
Contact area     : 0.0000997297
Distance to Corner: Dp : 0.0100924
Distance to Corner: Ds : 0.0100924
Effective Speed Factor : 2.659
Load-Life Factor : 16.4718
Expected Average Life : 2.79734 108
****
Contact name     : DsCo
Max Normal Load  : 26.2663
Max Normal Stress : -245306.
Displacement     : 0.000141442
Contact a-length : 0.0205148
Contact b-length : 0.0024947
Contact area     : 0.000160781
Distance to Corner : 0.00424591
Effective Speed Factor : 2.659
Load-Life Factor : 8.09858
Expected Average Life : 1.63463 107
```

=====

Ball number : 36
Ball angle : 0.
Ball position : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 37.1407
Residual Force Vector : {0.557705, 0.199261, -0.143309}
Displacement Residual : 2.43194 10⁻⁶

Contact name : DpCo
Max Normal Load : 19.9461
Max Normal Stress : -224878.
Displacement : 0.000118859
Contact a-length : 0.0188058
Contact b-length : 0.00228679
Contact area : 0.000135104
Distance to Corner : 0.00595484
Effective Speed Factor : 2.659
Load-Life Factor : 10.6647

Expected Average Life : 4.91565 10⁷

Contact name : DiCi
Max Normal Load : 14.974
Max Normal Stress : -201066.
Displacement : 0.0000950156
Contact a-length : 0.0168142
Contact b-length : 0.00204453
Contact area : 0.000107999
Distance to Corner: Dp : 0.00943585
Distance to Corner: Ds : 0.00943585
Effective Speed Factor : 2.659
Load-Life Factor : 14.206

Expected Average Life : 1.54762 10⁸

Contact name : DsCi
Max Normal Load : 24.2275
Max Normal Stress : -238991.
Displacement : 0.000134225
Contact a-length : 0.0199846
Contact b-length : 0.00242986
Contact area : 0.000152555
Distance to Corner : 0.00477609
Effective Speed Factor : 2.659
Load-Life Factor : 8.78009

Expected Average Life : 2.25829 10⁷

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.395194

Total Internal Loads (Fx,Fy,Fz)
 Primary Disk : {-330.919, 60.102, -505.545}
 Intermediate Disk : {12.0743, -23.0543, -23.7645}
 Secondary Disk : {319.988, -41.609, 531.859}

Total Axial Torque (Tz)
 Primary Disk : 31.7733
 Intermediate Disk : 1190.9
 Secondary Disk : -1200.

Torque Ratio: Ds/Dp : 37.7675
 Torque Ratio: Di/Dp : 37.4811
 Torque Ratio: Di/Ds : 0.992416

Torsional Stiffness (T/rad) : 173977.

Average Residual Force : {-0.0317412, 0.126704, -0.0708137}
-6

Average Displacement Residual : 1.21371 10

Dp Speed : 10.
 Ds Speed : 0.27027
 Speed Conversion Ratio : 37.
 Effective N.D. Speed : 20.
 Minimum Expected Average Life

7

hours : 3.40281 10
 years : 3884.49

Average Load-Life Factor: Dp : 10.5036
 Average Load-Life Factor: Di : 15.3547
 Average Load-Life Factor: Ds : 8.6056

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	:	-230767.
At ball number	:	35
Maximum Compressive Contact Stress Di	:	-201066.
At ball number	:	36
Maximum Compressive Contact Stress Ds	:	-238991.
At ball number	:	36
Maximum Ball Deflection Dp	:	0.000125153
At ball number	:	35
Maximum Ball Deflection Di	:	0.0000950156
At ball number	:	36
Maximum Ball Deflection Ds	:	0.000141442
At ball number	:	35
Maximum Ball Contact Area Dp	:	0.00014225
At ball number	:	35
Maximum Ball Contact Area Di	:	0.000107999
At ball number	:	36
Maximum Ball Contact Area Ds	:	0.000160781
At ball number	:	35
Maximum Ball a-patch Dp	:	0.0192974
At ball number	:	35
Maximum Ball a-patch Di	:	0.0168142
At ball number	:	36
Maximum Ball a-patch Ds	:	0.0205148
At ball number	:	35
Maximum Ball b-patch Dp	:	0.0023464
At ball number	:	35
Maximum Ball b-patch Di	:	0.00204453
At ball number	:	36
Maximum Ball b-patch Ds	:	0.0024947
At ball number	:	35
Minimum Distance to Dp Corner	:	0.00546327
At ball number	:	35
Minimum Distance to Di Corner: Dp	:	0.00943585
At ball number	:	36
Minimum Distance to Di Corner: Ds	:	0.00943585
At ball number	:	36
Minimum Distance to Ds Corner	:	0.00424591
At ball number	:	35

=====
=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 45 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter	= 0.15625
ConformingDiameter	= 0.1625
ConformingPercentage	= 52.
PrimaryFlankAngleDegrees	= 45.
IntermediateFlankAngleDegrees	= 0.
SecondaryFlankAngleDegrees	= 45.
PrimaryFractionBallDepth	= 0.3
SecondaryFractionBallDepth	= 0.3
ToleranceFraction	= 0.01
ContactToCornerDistance for Dp	= 0.0339308
ContactToCornerDistance for Ds	= 0.0339308

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

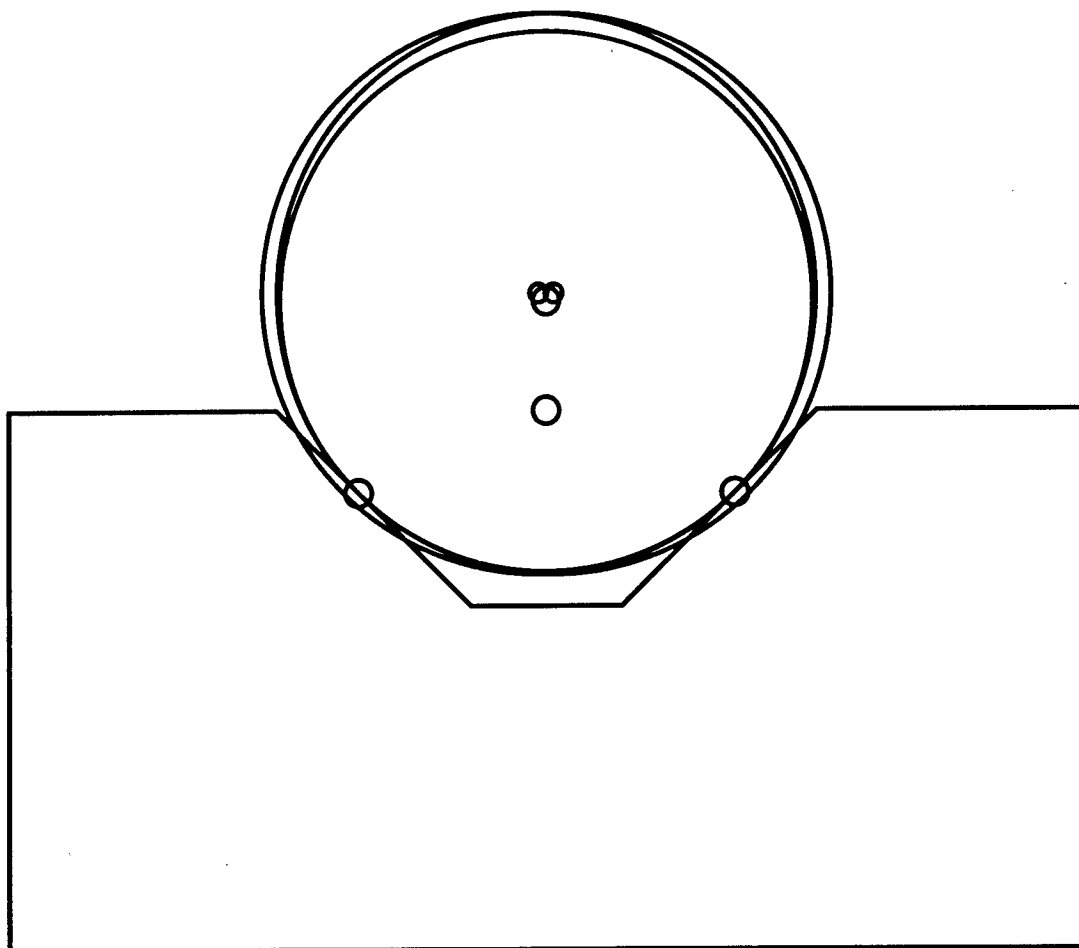
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition       = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta            = 1.
PrimaryAngleNumber           = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
1	0.	2.77556 10 ⁻¹⁷
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

Summary of Stress and Displacement Calculations

```

=====
Calculated for kinematic solution : 6
Angular Deformation                : 0.441531
Applied Torque                     : 1199.99

```


=====

Ball number : 1
Ball angle : 350.
Ball position : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.2798
Residual Force Vector : {0.604874, 0.200643, -0.0454489}

-6

Displacement Residual : 2.45684 10

Contact name : DpCo
Max Normal Load : 22.4125
Max Normal Stress : -233383.
Displacement : 0.000128019
Contact a-length : 0.0195171
Contact b-length : 0.00237328
Contact area : 0.000145517
Distance to Corner : 0.0144137
Effective Speed Factor : 2.659
Load-Life Factor : 9.49115

7

Expected Average Life : 3.08361 10

Contact name : DiCi
Max Normal Load : 15.1178
Max Normal Stress : -201541.
Displacement : 0.0000954651
Contact a-length : 0.0168539
Contact b-length : 0.00204936
Contact area : 0.00010851
Distance to Corner: Dp : 0.00939612
Distance to Corner: Ds : 0.00939612
Effective Speed Factor : 2.659
Load-Life Factor : 14.0708

8

Expected Average Life : 1.48956 10

Contact name : DsCi
Max Normal Load : 26.2019
Max Normal Stress : -245535.
Displacement : 0.000141676
Contact a-length : 0.0205318
Contact b-length : 0.00249639
Contact area : 0.000161023
Distance to Corner : 0.013399
Effective Speed Factor : 2.659
Load-Life Factor : 8.11848

7

Expected Average Life : 1.65076 10

=====

Ball number : 2
 Ball angle : 340.
 Ball position : {-0.640757, 2.39134, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.3688
 Residual Force Vector : {0.551484, 0.300355, -0.047294}
 Displacement Residual : 2.42432 10⁻⁶

Contact name : DpCo
 Max Normal Load : 22.3461
 Max Normal Stress : -233151.
 Displacement : 0.000127765
 Contact a-length : 0.0194977
 Contact b-length : 0.00237092
 Contact area : 0.000145228
 Distance to Corner : 0.0144331
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.51933

Expected Average Life : 3.1204 10⁷

Contact name : DiCi
 Max Normal Load : 15.1111
 Max Normal Stress : -201546.
 Displacement : 0.0000954696
 Contact a-length : 0.0168543
 Contact b-length : 0.00204941
 Contact area : 0.000108515
 Distance to Corner: Dp : 0.00939573
 Distance to Corner: Ds : 0.00939573
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.0771

Expected Average Life : 1.49223 10⁸

Contact name : DsCi
 Max Normal Load : 26.1505
 Max Normal Stress : -245364.
 Displacement : 0.000141479
 Contact a-length : 0.0205175
 Contact b-length : 0.00249465
 Contact area : 0.000160799
 Distance to Corner : 0.0134133
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.13445

Expected Average Life : 1.66378 10⁷

```
=====
Ball number      : 3
Ball angle       : 330.
Ball position    : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 34.4582
Residual Force Vector : {0.482145, 0.387664, -0.0491132}
                                     -6
Displacement Residual : 2.39182 10
****
Contact name      : DpCo
Max Normal Load   : 22.2795
Max Normal Stress : -232917.
Displacement      : 0.000127509
Contact a-length  : 0.0194782
Contact b-length  : 0.00236855
Contact area      : 0.000144937
Distance to Corner : 0.0144527
Effective Speed Factor : 2.659
Load-Life Factor  : 9.54778
                                     7
Expected Average Life : 3.15786 10
****
Contact name      : DiCi
Max Normal Load   : 15.1041
Max Normal Stress : -201550.
Displacement      : 0.0000954732
Contact a-length  : 0.0168546
Contact b-length  : 0.00204945
Contact area      : 0.000108519
Distance to Corner: Dp : 0.0093954
Distance to Corner: Ds : 0.0093954
Effective Speed Factor : 2.659
Load-Life Factor  : 14.0836
                                     8
Expected Average Life : 1.49497 10
****
Contact name      : DsCi
Max Normal Load   : 26.0988
Max Normal Stress : -245192.
Displacement      : 0.000141281
Contact a-length  : 0.0205031
Contact b-length  : 0.0024929
Contact area      : 0.000160574
Distance to Corner : 0.0134277
Effective Speed Factor : 2.659
Load-Life Factor  : 8.15056
                                     7
Expected Average Life : 1.67701 10
```

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.5479
Residual Force Vector : {0.39953, 0.460112, -0.0509058}

-6
Displacement Residual : 2.35934 10

Contact name : DpCo
Max Normal Load : 22.2127
Max Normal Stress : -232683.
Displacement : 0.000127252
Contact a-length : 0.0194585
Contact b-length : 0.00236616
Contact area : 0.000144645
Distance to Corner : 0.0144723
Effective Speed Factor : 2.659
Load-Life Factor : 9.57649

7
Expected Average Life : 3.19602 10

Contact name : DiCi
Max Normal Load : 15.097
Max Normal Stress : -201553.
Displacement : 0.0000954761
Contact a-length : 0.0168549
Contact b-length : 0.00204948
Contact area : 0.000108522
Distance to Corner: Dp : 0.00939515
Distance to Corner: Ds : 0.00939515
Effective Speed Factor : 2.659
Load-Life Factor : 14.0902

8
Expected Average Life : 1.4978 10

Contact name : DsCi
Max Normal Load : 26.0468
Max Normal Stress : -245019.
Displacement : 0.000141081
Contact a-length : 0.0204886
Contact b-length : 0.00249115
Contact area : 0.000160348
Distance to Corner : 0.0134422
Effective Speed Factor : 2.659
Load-Life Factor : 8.16682

7
Expected Average Life : 1.69043 10

```

=====
Ball number      : 5
Ball angle       : 310.
Ball position    : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 34.638
Residual Force Vector : {0.306674, 0.515793, -0.052671}
                                     -6
Displacement Residual : 2.32689 10
****
Contact name      : DpCo
Max Normal Load   : 22.1457
Max Normal Stress : -232447.
Displacement      : 0.000126994
Contact a-length  : 0.0194388
Contact b-length  : 0.00236376
Contact area      : 0.000144352
Distance to Corner : 0.014492
Effective Speed Factor : 2.659
Load-Life Factor  : 9.60548
                                     7
Expected Average Life : 3.23489 10
****
Contact name      : DiCi
Max Normal Load   : 15.0897
Max Normal Stress : -201555.
Displacement      : 0.0000954782
Contact a-length  : 0.016855
Contact b-length  : 0.0020495
Contact area      : 0.000108525
Distance to Corner: Dp : 0.00939496
Distance to Corner: Ds : 0.00939496
Effective Speed Factor : 2.659
Load-Life Factor  : 14.097
                                     8
Expected Average Life : 1.5007 10
****
Contact name      : DsCi
Max Normal Load   : 25.9946
Max Normal Stress : -244845.
Displacement      : 0.000140881
Contact a-length  : 0.0204741
Contact b-length  : 0.00248938
Contact area      : 0.00016012
Distance to Corner : 0.0134567
Effective Speed Factor : 2.659
Load-Life Factor  : 8.18323
                                     7
Expected Average Life : 1.70405 10

```

=====

Ball number : 6
 Ball angle : 300.
 Ball position : {-1.98815, 1.39212, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.7284
 Residual Force Vector : {0.206861, 0.553397, -0.0544083}

-6
 Displacement Residual : 2.29447 10

Contact name : DpCo
 Max Normal Load : 22.0784
 Max Normal Stress : -232209.
 Displacement : 0.000126735
 Contact a-length : 0.019419
 Contact b-length : 0.00236135
 Contact area : 0.000144057
 Distance to Corner : 0.0145119
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.63474

7
 Expected Average Life : 3.27449 10

Contact name : DiCi
 Max Normal Load : 15.0822
 Max Normal Stress : -201556.
 Displacement : 0.0000954794
 Contact a-length : 0.0168551
 Contact b-length : 0.00204952
 Contact area : 0.000108526
 Distance to Corner: Dp : 0.00939485
 Distance to Corner: Ds : 0.00939485
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.104

8
 Expected Average Life : 1.50368 10

Contact name : DsCi
 Max Normal Load : 25.9422
 Max Normal Stress : -244670.
 Displacement : 0.00014068
 Contact a-length : 0.0204595
 Contact b-length : 0.0024876
 Contact area : 0.000159891
 Distance to Corner : 0.0134714
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.19978

7
 Expected Average Life : 1.71788 10

=====

Ball number : 7
 Ball angle : 290.
 Ball position : {-2.18867, 1.02059, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 34.8193
 Residual Force Vector : {0.10351, 0.572239, -0.0561169}
 Displacement Residual : 2.26208 10

Contact name : DpCo
 Max Normal Load : 22.011
 Max Normal Stress : -231971.
 Displacement : 0.000126475
 Contact a-length : 0.019399
 Contact b-length : 0.00235892
 Contact area : 0.000143761
 Distance to Corner : 0.0145318
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.66427

Expected Average Life : 3.31483 10

Contact name : DiCi
 Max Normal Load : 15.0745
 Max Normal Stress : -201557.
 Displacement : 0.0000954798
 Contact a-length : 0.0168552
 Contact b-length : 0.00204952
 Contact area : 0.000108526
 Distance to Corner: Dp : 0.00939482
 Distance to Corner: Ds : 0.00939482
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.1112

Expected Average Life : 1.50675 10

Contact name : DsCi
 Max Normal Load : 25.8894
 Max Normal Stress : -244494.
 Displacement : 0.000140478
 Contact a-length : 0.0204447
 Contact b-length : 0.00248581
 Contact area : 0.000159661
 Distance to Corner : 0.0134861
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.21648

Expected Average Life : 1.73192 10

=====

Ball number : 8
Ball angle : 280.
Ball position : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.9105
Residual Force Vector : {0.000060834, 0.572267, -0.0577961}

-6
Displacement Residual : 2.22972 10

Contact name : DpCo
Max Normal Load : 21.9433
Max Normal Stress : -231731.
Displacement : 0.000126213
Contact a-length : 0.0193789
Contact b-length : 0.00235648
Contact area : 0.000143464
Distance to Corner : 0.0145519
Effective Speed Factor : 2.659
Load-Life Factor : 9.69409

7
Expected Average Life : 3.35592 10

Contact name : DiCi
Max Normal Load : 15.0667
Max Normal Stress : -201556.
Displacement : 0.0000954794
Contact a-length : 0.0168551
Contact b-length : 0.00204952
Contact area : 0.000108526
Distance to Corner: Dp : 0.00939486
Distance to Corner: Ds : 0.00939486
Effective Speed Factor : 2.659
Load-Life Factor : 14.1186

8
Expected Average Life : 1.50989 10

Contact name : DsCi
Max Normal Load : 25.8364
Max Normal Stress : -244317.
Displacement : 0.000140274
Contact a-length : 0.0204299
Contact b-length : 0.00248401
Contact area : 0.00015943
Distance to Corner : 0.0135009
Effective Speed Factor : 2.659
Load-Life Factor : 8.23334

7
Expected Average Life : 1.74617 10


```

=====
Ball number      : 9
Ball angle       : 270.
Ball position    : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 35.0021
Residual Force Vector : {-0.100142, 0.554044, -0.0594453}
Displacement Residual : 2.19739 10-6
****
Contact name     : DpCo
Max Normal Load  : 21.8753
Max Normal Stress : -231489.
Displacement     : 0.00012595
Contact a-length : 0.0193587
Contact b-length : 0.00235402
Contact area     : 0.000143165
Distance to Corner : 0.0145721
Effective Speed Factor : 2.659
Load-Life Factor : 9.72419
Expected Average Life : 3.39779 107
****
Contact name     : DiCi
Max Normal Load  : 15.0586
Max Normal Stress : -201555.
Displacement     : 0.0000954781
Contact a-length : 0.016855
Contact b-length : 0.0020495
Contact area     : 0.000108524
Distance to Corner: Dp : 0.00939497
Distance to Corner: Ds : 0.00939497
Effective Speed Factor : 2.659
Load-Life Factor : 14.1261
Expected Average Life : 1.51312 108
****
Contact name     : DsCi
Max Normal Load  : 25.7832
Max Normal Stress : -244139.
Displacement     : 0.00014007
Contact a-length : 0.020415
Contact b-length : 0.0024822
Contact area     : 0.000159198
Distance to Corner : 0.0135158
Effective Speed Factor : 2.659
Load-Life Factor : 8.25034
Expected Average Life : 1.76065 107

```

=====

Ball number : 10
Ball angle : 260.
Ball position : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.094
Residual Force Vector : {-0.193955, 0.518715, -0.0610636}

-6
Displacement Residual : 2.16511 10

Contact name : DpCo
Max Normal Load : 21.8072
Max Normal Stress : -231246.
Displacement : 0.000125686
Contact a-length : 0.0193384
Contact b-length : 0.00235155
Contact area : 0.000142865
Distance to Corner : 0.0145924
Effective Speed Factor : 2.659
Load-Life Factor : 9.75457

7
Expected Average Life : 3.44046 10

Contact name : DiCi
Max Normal Load : 15.0504
Max Normal Stress : -201553.
Displacement : 0.000095476
Contact a-length : 0.0168548
Contact b-length : 0.00204948
Contact area : 0.000108522
Distance to Corner: Dp : 0.00939516
Distance to Corner: Ds : 0.00939516
Effective Speed Factor : 2.659
Load-Life Factor : 14.1338

8
Expected Average Life : 1.51643 10

Contact name : DsCi
Max Normal Load : 25.7296
Max Normal Stress : -243960.
Displacement : 0.000139864
Contact a-length : 0.0204001
Contact b-length : 0.00248038
Contact area : 0.000158964
Distance to Corner : 0.0135308
Effective Speed Factor : 2.659
Load-Life Factor : 8.26751

7
Expected Average Life : 1.77534 10

=====

Ball number : 11
 Ball angle : 250.
 Ball position : {-2.28569, -0.612449, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 35.1863
 Residual Force Vector : {-0.278537, 0.467952, -0.0626505}

Displacement Residual : 2.13286 10⁻⁶

Contact name : DpCo
 Max Normal Load : 21.7388
 Max Normal Stress : -231002.
 Displacement : 0.000125421
 Contact a-length : 0.019318
 Contact b-length : 0.00234907
 Contact area : 0.000142563
 Distance to Corner : 0.0146128
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.78525

Expected Average Life : 3.48394 10⁷

Contact name : DiCi
 Max Normal Load : 15.042
 Max Normal Stress : -201549.
 Displacement : 0.0000954729
 Contact a-length : 0.0168546
 Contact b-length : 0.00204945
 Contact area : 0.000108519
 Distance to Corner: Dp : 0.00939543
 Distance to Corner: Ds : 0.00939543
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.1417

Expected Average Life : 1.51983 10⁸

Contact name : DsCi
 Max Normal Load : 25.6759
 Max Normal Stress : -243780.
 Displacement : 0.000139658
 Contact a-length : 0.020385
 Contact b-length : 0.00247854
 Contact area : 0.000158729
 Distance to Corner : 0.0135458
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.28483

Expected Average Life : 1.79027 10⁷

=====

Ball number : 12
Ball angle : 240.
Ball position : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.279
Residual Force Vector : {-0.351434, 0.403882, -0.0642052}

Displacement Residual : 2.10066 10⁻⁶

Contact name : DpCo
Max Normal Load : 21.6703
Max Normal Stress : -230757.
Displacement : 0.000125154
Contact a-length : 0.0192975
Contact b-length : 0.00234657
Contact area : 0.00014226
Distance to Corner : 0.0146334
Effective Speed Factor : 2.659
Load-Life Factor : 9.81621

Expected Average Life : 3.52825 10⁷

Contact name : DiCi
Max Normal Load : 15.0334
Max Normal Stress : -201545.
Displacement : 0.000095469
Contact a-length : 0.0168542
Contact b-length : 0.0020494
Contact area : 0.000108514
Distance to Corner: Dp : 0.00939577
Distance to Corner: Ds : 0.00939577
Effective Speed Factor : 2.659
Load-Life Factor : 14.1499

Expected Average Life : 1.52332 10⁸

Contact name : DsCi
Max Normal Load : 25.6218
Max Normal Stress : -243598.
Displacement : 0.00013945
Contact a-length : 0.0203698
Contact b-length : 0.0024767
Contact area : 0.000158493
Distance to Corner : 0.013561
Effective Speed Factor : 2.659
Load-Life Factor : 8.30231

Expected Average Life : 1.80542 10⁷

=====

Ball number : 13
Ball angle : 230.
Ball position : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.3721
Residual Force Vector : {-0.410649, 0.329009, -0.065727}

Displacement Residual : 2.06851 10⁻⁶

Contact name : DpCo
Max Normal Load : 21.6015
Max Normal Stress : -230510.
Displacement : 0.000124887
Contact a-length : 0.0192768
Contact b-length : 0.00234406
Contact area : 0.000141956
Distance to Corner : 0.014654
Effective Speed Factor : 2.659
Load-Life Factor : 9.84748

Expected Average Life : 3.57341 10⁷

Contact name : DiCi
Max Normal Load : 15.0246
Max Normal Stress : -201540.
Displacement : 0.0000954642
Contact a-length : 0.0168538
Contact b-length : 0.00204935
Contact area : 0.000108509
Distance to Corner: Dp : 0.0093962
Distance to Corner: Ds : 0.0093962
Effective Speed Factor : 2.659
Load-Life Factor : 14.1581

Expected Average Life : 1.52689 10⁸

Contact name : DsCi
Max Normal Load : 25.5675
Max Normal Stress : -243416.
Displacement : 0.000139241
Contact a-length : 0.0203546
Contact b-length : 0.00247485
Contact area : 0.000158256
Distance to Corner : 0.0135762
Effective Speed Factor : 2.659
Load-Life Factor : 8.31995

Expected Average Life : 1.82081 10⁷

=====

Ball number : 14
 Ball angle : 220.
 Ball position : {-1.64746, -1.64746, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 35.4655
 Residual Force Vector : {-0.454696, 0.246116, -0.0672152}

-6
 Displacement Residual : 2.0364 10

Contact name : DpCo
 Max Normal Load : 21.5325
 Max Normal Stress : -230261.
 Displacement : 0.000124618
 Contact a-length : 0.019256
 Contact b-length : 0.00234153
 Contact area : 0.00014165
 Distance to Corner : 0.0146748
 Effective Speed Factor : 2.659
 Load-Life Factor : 9.87904

7
 Expected Average Life : 3.61945 10

Contact name : DiCi
 Max Normal Load : 15.0156
 Max Normal Stress : -201534.
 Displacement : 0.0000954585
 Contact a-length : 0.0168533
 Contact b-length : 0.00204929
 Contact area : 0.000108502
 Distance to Corner: Dp : 0.0093967
 Distance to Corner: Ds : 0.0093967
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.1666

8
 Expected Average Life : 1.53056 10

Contact name : DsCi
 Max Normal Load : 25.5129
 Max Normal Stress : -243233.
 Displacement : 0.000139032
 Contact a-length : 0.0203393
 Contact b-length : 0.00247298
 Contact area : 0.000158018
 Distance to Corner : 0.0135916
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.33775

7
 Expected Average Life : 1.83645 10

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.5594
Residual Force Vector : {-0.482634, 0.158164, -0.068669}

Displacement Residual : 2.00435 10⁻⁶

Contact name : DpCo
Max Normal Load : 21.4632
Max Normal Stress : -230012.
Displacement : 0.000124347
Contact a-length : 0.0192351
Contact b-length : 0.00233899
Contact area : 0.000141343
Distance to Corner : 0.0146957
Effective Speed Factor : 2.659
Load-Life Factor : 9.9109

Expected Average Life : 3.66637 10⁷

Contact name : DiCi
Max Normal Load : 15.0064
Max Normal Stress : -201527.
Displacement : 0.0000954519
Contact a-length : 0.0168527
Contact b-length : 0.00204922
Contact area : 0.000108495
Distance to Corner: Dp : 0.00939728
Distance to Corner: Ds : 0.00939728
Effective Speed Factor : 2.659
Load-Life Factor : 14.1753

Expected Average Life : 1.53431 10⁸

Contact name : DsCi
Max Normal Load : 25.458
Max Normal Stress : -243048.
Displacement : 0.000138821
Contact a-length : 0.0203238
Contact b-length : 0.00247111
Contact area : 0.000157778
Distance to Corner : 0.013607
Effective Speed Factor : 2.659
Load-Life Factor : 8.35572

Expected Average Life : 1.85233 10⁷

=====

Ball number : 16
Ball angle : 200.
Ball position : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.6536
Residual Force Vector : {-0.494085, 0.0681891, -0.0700877}

-6
Displacement Residual : 1.97236 10

Contact name : DpCo
Max Normal Load : 21.3938
Max Normal Stress : -229760.
Displacement : 0.000124076
Contact a-length : 0.0192141
Contact b-length : 0.00233644
Contact area : 0.000141034
Distance to Corner : 0.0147167
Effective Speed Factor : 2.659
Load-Life Factor : 9.94307

7
Expected Average Life : 3.7142 10

Contact name : DiCi
Max Normal Load : 14.997
Max Normal Stress : -201519.
Displacement : 0.0000954444
Contact a-length : 0.0168521
Contact b-length : 0.00204914
Contact area : 0.000108486
Distance to Corner: Dp : 0.00939795
Distance to Corner: Ds : 0.00939795
Effective Speed Factor : 2.659
Load-Life Factor : 14.1842

8
Expected Average Life : 1.53815 10

Contact name : DsCi
Max Normal Load : 25.4029
Max Normal Stress : -242863.
Displacement : 0.000138609
Contact a-length : 0.0203083
Contact b-length : 0.00246922
Contact area : 0.000157538
Distance to Corner : 0.0136225
Effective Speed Factor : 2.659
Load-Life Factor : 8.37385

7
Expected Average Life : 1.86846 10

=====

Ball number : 17
Ball angle : 190.
Ball position : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 35.7481
Residual Force Vector : {-0.489227, -0.0208005, -0.0714705}

-6
Displacement Residual : 1.94042 10

Contact name : DpCo
Max Normal Load : 21.3241
Max Normal Stress : -229508.
Displacement : 0.000123803
Contact a-length : 0.019193
Contact b-length : 0.00233387
Contact area : 0.000140724
Distance to Corner : 0.0147378
Effective Speed Factor : 2.659
Load-Life Factor : 9.97555

7
Expected Average Life : 3.76297 10

Contact name : DiCi
Max Normal Load : 14.9874
Max Normal Stress : -201510.
Displacement : 0.000095436
Contact a-length : 0.0168513
Contact b-length : 0.00204905
Contact area : 0.000108477
Distance to Corner: Dp : 0.00939869
Distance to Corner: Ds : 0.00939869
Effective Speed Factor : 2.659
Load-Life Factor : 14.1932

8
Expected Average Life : 1.54209 10

Contact name : DsCi
Max Normal Load : 25.3475
Max Normal Stress : -242676.
Displacement : 0.000138396
Contact a-length : 0.0202927
Contact b-length : 0.00246733
Contact area : 0.000157296
Distance to Corner : 0.0136381
Effective Speed Factor : 2.659
Load-Life Factor : 8.39215

7
Expected Average Life : 1.88485 10

=====

Ball number : 18
Ball angle : 180.
Ball position : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 29.2646
Residual Force Vector : {-0.1222, 0.00226843, 0.0108779}

-7
Displacement Residual : 4.88825 10

Contact name : DpCi
Max Normal Load : 23.039
Max Normal Stress : -234845.
Displacement : 0.000129617
Contact a-length : 0.0196385
Contact b-length : 0.00238788
Contact area : 0.000147323
Distance to Corner : 0.0142923
Effective Speed Factor : 2.659
Load-Life Factor : 9.23303

7
Expected Average Life : 2.7616 10

Contact name : DiCi
Max Normal Load : 12.9939
Max Normal Stress : -193438.
Displacement : 0.0000879425
Contact a-length : 0.0161762
Contact b-length : 0.00196696
Contact area : 0.0000999592
Distance to Corner: Dp : 0.0100738
Distance to Corner: Ds : 0.0100738
Effective Speed Factor : 2.659
Load-Life Factor : 16.3708

8
Expected Average Life : 2.72936 10

Contact name : DsCo
Max Normal Load : 27.2505
Max Normal Stress : -248366.
Displacement : 0.000144993
Contact a-length : 0.0207707
Contact b-length : 0.00252582
Contact area : 0.000164817
Distance to Corner : 0.0131602
Effective Speed Factor : 2.659
Load-Life Factor : 7.8061

7
Expected Average Life : 1.41098 10

=====

Ball number : 19
Ball angle : 170.
Ball position : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 29.1677
Residual Force Vector : {-0.120737, -0.0188149, 0.0105992}

Displacement Residual : 4.897 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.1156
Max Normal Stress : -235106.
Displacement : 0.000129904
Contact a-length : 0.0196603
Contact b-length : 0.00239053
Contact area : 0.00014765
Distance to Corner : 0.0142706
Effective Speed Factor : 2.659
Load-Life Factor : 9.20244

Expected Average Life : 2.72519 10⁷

Contact name : DiCi
Max Normal Load : 12.987
Max Normal Stress : -193402.
Displacement : 0.0000879105
Contact a-length : 0.0161733
Contact b-length : 0.0019666
Contact area : 0.0000999228
Distance to Corner: Dp : 0.0100767
Distance to Corner: Ds : 0.0100767
Effective Speed Factor : 2.659
Load-Life Factor : 16.3795

Expected Average Life : 2.73516 10⁸

Contact name : DsCo
Max Normal Load : 27.314
Max Normal Stress : -248558.
Displacement : 0.000145217
Contact a-length : 0.0207867
Contact b-length : 0.00252777
Contact area : 0.000165072
Distance to Corner : 0.0131441
Effective Speed Factor : 2.659
Load-Life Factor : 7.78794

Expected Average Life : 1.39789 10⁷

=====

Ball number : 20
Ball angle : 160.
Ball position : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 29.0713
Residual Force Vector : {-0.115667, -0.039332, 0.0103272}

-7
Displacement Residual : 4.9057 10

Contact name : DpCi
Max Normal Load : 23.1919
Max Normal Stress : -235364.
Displacement : 0.00013019
Contact a-length : 0.0196819
Contact b-length : 0.00239316
Contact area : 0.000147975
Distance to Corner : 0.0142489
Effective Speed Factor : 2.659
Load-Life Factor : 9.17217

7
Expected Average Life : 2.6895 10

Contact name : DiCi
Max Normal Load : 12.9799
Max Normal Stress : -193366.
Displacement : 0.0000878775
Contact a-length : 0.0161702
Contact b-length : 0.00196623
Contact area : 0.0000998853
Distance to Corner: Dp : 0.0100798
Distance to Corner: Ds : 0.0100798
Effective Speed Factor : 2.659
Load-Life Factor : 16.3884

8
Expected Average Life : 2.74115 10

Contact name : DsCo
Max Normal Load : 27.3773
Max Normal Stress : -248748.
Displacement : 0.00014544
Contact a-length : 0.0208027
Contact b-length : 0.00252971
Contact area : 0.000165325
Distance to Corner : 0.0131282
Effective Speed Factor : 2.659
Load-Life Factor : 7.76995

7
Expected Average Life : 1.38502 10

```

=====
Ball number      : 21
Ball angle       : 150.
Ball position    : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 28.9752
Residual Force Vector : {-0.107138, -0.05867, 0.0100617}
Displacement Residual : 4.91437 10-7
****
Contact name     : DpCi
Max Normal Load  : 23.2679
Max Normal Stress : -235622.
Displacement     : 0.000130475
Contact a-length : 0.0197034
Contact b-length : 0.00239578
Contact area     : 0.000148299
Distance to Corner : 0.0142274
Effective Speed Factor : 2.659
Load-Life Factor : 9.1422
Expected Average Life : 2.65452 107
****
Contact name     : DiCi
Max Normal Load  : 12.9726
Max Normal Stress : -193329.
Displacement     : 0.0000878436
Contact a-length : 0.0161671
Contact b-length : 0.00196586
Contact area     : 0.0000998468
Distance to Corner: Dp : 0.0100829
Distance to Corner: Ds : 0.0100829
Effective Speed Factor : 2.659
Load-Life Factor : 16.3977
Expected Average Life : 2.74734 108
****
Contact name     : DsCo
Max Normal Load  : 27.4402
Max Normal Stress : -248938.
Displacement     : 0.000145662
Contact a-length : 0.0208185
Contact b-length : 0.00253164
Contact area     : 0.000165577
Distance to Corner : 0.0131123
Effective Speed Factor : 2.659
Load-Life Factor : 7.75213
Expected Average Life : 1.37236 107

```

=====

Ball number : 22
Ball angle : 140.
Ball position : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.8795
Residual Force Vector : {-0.095406, -0.0762509, 0.00980237}

Displacement Residual : 4.92299 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.3437
Max Normal Stress : -235877.
Displacement : 0.000130758
Contact a-length : 0.0197248
Contact b-length : 0.00239837
Contact area : 0.000148621
Distance to Corner : 0.014206
Effective Speed Factor : 2.659
Load-Life Factor : 9.11253

Expected Average Life : 2.62023 10⁷

Contact name : DiCi
Max Normal Load : 12.9651
Max Normal Stress : -193290.
Displacement : 0.0000878087
Contact a-length : 0.0161639
Contact b-length : 0.00196547
Contact area : 0.0000998072
Distance to Corner: Dp : 0.0100861
Distance to Corner: Ds : 0.0100861
Effective Speed Factor : 2.659
Load-Life Factor : 16.4072

Expected Average Life : 2.75372 10⁸

Contact name : DsCo
Max Normal Load : 27.5028
Max Normal Stress : -249126.
Displacement : 0.000145882
Contact a-length : 0.0208343
Contact b-length : 0.00253355
Contact area : 0.000165828
Distance to Corner : 0.0130966
Effective Speed Factor : 2.659
Load-Life Factor : 7.73447

Expected Average Life : 1.3599 10⁷

=====

Ball number : 23
Ball angle : 130.
Ball position : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.7842
Residual Force Vector : {-0.0808188, -0.0915483, 0.00954913}
Displacement Residual : 4.93156 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.4192
Max Normal Stress : -236132.
Displacement : 0.00013104
Contact a-length : 0.019746
Contact b-length : 0.00240096
Contact area : 0.000148941
Distance to Corner : 0.0141848
Effective Speed Factor : 2.659
Load-Life Factor : 9.08316

Expected Average Life : 2.58662 10⁷

Contact name : DiCi
Max Normal Load : 12.9573
Max Normal Stress : -193251.
Displacement : 0.0000877729
Contact a-length : 0.0161606
Contact b-length : 0.00196506
Contact area : 0.0000997665
Distance to Corner: Dp : 0.0100894
Distance to Corner: Ds : 0.0100894
Effective Speed Factor : 2.659
Load-Life Factor : 16.417

Expected Average Life : 2.76029 10⁸

Contact name : DsCo
Max Normal Load : 27.5652
Max Normal Stress : -249314.
Displacement : 0.000146102
Contact a-length : 0.0208499
Contact b-length : 0.00253546
Contact area : 0.000166078
Distance to Corner : 0.0130809
Effective Speed Factor : 2.659
Load-Life Factor : 7.71698

Expected Average Life : 1.34764 10⁷

=====

Ball number : 24
Ball angle : 120.
Ball position : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.6893
Residual Force Vector : {-0.0638121, -0.104104, 0.00930176}
Displacement Residual : 4.94007 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.4943
Max Normal Stress : -236384.
Displacement : 0.000131321
Contact a-length : 0.0197672
Contact b-length : 0.00240353
Contact area : 0.00014926
Distance to Corner : 0.0141636
Effective Speed Factor : 2.659
Load-Life Factor : 9.05409

Expected Average Life : 2.55366 10⁷

Contact name : DiCi
Max Normal Load : 12.9494
Max Normal Stress : -193211.
Displacement : 0.0000877362
Contact a-length : 0.0161572
Contact b-length : 0.00196465
Contact area : 0.0000997247
Distance to Corner: Dp : 0.0100928
Distance to Corner: Ds : 0.0100928
Effective Speed Factor : 2.659
Load-Life Factor : 16.427

Expected Average Life : 2.76706 10⁸

Contact name : DsCo
Max Normal Load : 27.6272
Max Normal Stress : -249500.
Displacement : 0.00014632
Contact a-length : 0.0208655
Contact b-length : 0.00253735
Contact area : 0.000166326
Distance to Corner : 0.0130653
Effective Speed Factor : 2.659
Load-Life Factor : 7.69965

Expected Average Life : 1.33557 10⁷

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.5948
Residual Force Vector : {-0.0448939, -0.11354, 0.00906007}

Displacement Residual : 4.94853 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.5693
Max Normal Stress : -236635.
Displacement : 0.0001316
Contact a-length : 0.0197882
Contact b-length : 0.00240608
Contact area : 0.000149577
Distance to Corner : 0.0141426
Effective Speed Factor : 2.659
Load-Life Factor : 9.02532

Expected Average Life : 2.52135 10⁷

Contact name : DiCi
Max Normal Load : 12.9413
Max Normal Stress : -193169.
Displacement : 0.0000876986
Contact a-length : 0.0161538
Contact b-length : 0.00196423
Contact area : 0.0000996819
Distance to Corner: Dp : 0.0100962
Distance to Corner: Ds : 0.0100962
Effective Speed Factor : 2.659
Load-Life Factor : 16.4373

Expected Average Life : 2.77401 10⁸

Contact name : DsCo
Max Normal Load : 27.689
Max Normal Stress : -249685.
Displacement : 0.000146537
Contact a-length : 0.020881
Contact b-length : 0.00253923
Contact area : 0.000166572
Distance to Corner : 0.0130499
Effective Speed Factor : 2.659
Load-Life Factor : 7.68247

Expected Average Life : 1.32369 10⁷

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.5007
Residual Force Vector : {-0.0246299, -0.119574, 0.00882388}

-7
Displacement Residual : 4.95692 10

Contact name : DpCi
Max Normal Load : 23.6439
Max Normal Stress : -236885.
Displacement : 0.000131878
Contact a-length : 0.0198091
Contact b-length : 0.00240862
Contact area : 0.000149893
Distance to Corner : 0.0141218
Effective Speed Factor : 2.659
Load-Life Factor : 8.99683

7
Expected Average Life : 2.48967 10

Contact name : DiCi
Max Normal Load : 12.933
Max Normal Stress : -193127.
Displacement : 0.00008766
Contact a-length : 0.0161502
Contact b-length : 0.0019638
Contact area : 0.0000996381
Distance to Corner: Dp : 0.0100998
Distance to Corner: Ds : 0.0100998
Effective Speed Factor : 2.659
Load-Life Factor : 16.4479

8
Expected Average Life : 2.78116 10

Contact name : DsCo
Max Normal Load : 27.7505
Max Normal Stress : -249869.
Displacement : 0.000146753
Contact a-length : 0.0208963
Contact b-length : 0.0025411
Contact area : 0.000166818
Distance to Corner : 0.0130345
Effective Speed Factor : 2.659
Load-Life Factor : 7.66546

7
Expected Average Life : 1.31201 10

```
=====
Ball number      : 27
Ball angle       : 90.
Ball position    : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 28.4069
Residual Force Vector : {-0.00362664, -0.122022, 0.00859303}
Displacement Residual : 4.96524 10-7
****
Contact name     : DpCi
Max Normal Load  : 23.7182
Max Normal Stress : -237133.
Displacement     : 0.000132154
Contact a-length : 0.0198298
Contact b-length : 0.00241114
Contact area     : 0.000150207
Distance to Corner : 0.014101
Effective Speed Factor : 2.659
Load-Life Factor : 8.96863
Expected Average Life : 2.4586 107
****
Contact name     : DiCi
Max Normal Load  : 12.9244
Max Normal Stress : -193083.
Displacement     : 0.0000876206
Contact a-length : 0.0161466
Contact b-length : 0.00196336
Contact area     : 0.0000995933
Distance to Corner: Dp : 0.0101034
Distance to Corner: Ds : 0.0101034
Effective Speed Factor : 2.659
Load-Life Factor : 16.4587
Expected Average Life : 2.7885 108
****
Contact name     : DsCo
Max Normal Load  : 27.8116
Max Normal Stress : -250051.
Displacement     : 0.000146968
Contact a-length : 0.0209116
Contact b-length : 0.00254296
Contact area     : 0.000167062
Distance to Corner : 0.0130192
Effective Speed Factor : 2.659
Load-Life Factor : 7.6486
Expected Average Life : 1.3005 107
```

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.3136
Residual Force Vector : {0.0174865, -0.12081, 0.00836737}

Displacement Residual : 4.97349 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.7923
Max Normal Stress : -237380.
Displacement : 0.00013243
Contact a-length : 0.0198505
Contact b-length : 0.00241365
Contact area : 0.00015052
Distance to Corner : 0.0140804
Effective Speed Factor : 2.659
Load-Life Factor : 8.94071

Expected Average Life : 2.42813 10⁷

Contact name : DiCi
Max Normal Load : 12.9157
Max Normal Stress : -193039.
Displacement : 0.0000875803
Contact a-length : 0.0161429
Contact b-length : 0.00196291
Contact area : 0.0000995475
Distance to Corner: Dp : 0.0101071
Distance to Corner: Ds : 0.0101071
Effective Speed Factor : 2.659
Load-Life Factor : 16.4698

Expected Average Life : 2.79603 10⁸

Contact name : DsCo
Max Normal Load : 27.8725
Max Normal Stress : -250233.
Displacement : 0.000147181
Contact a-length : 0.0209268
Contact b-length : 0.00254481
Contact area : 0.000167304
Distance to Corner : 0.013004
Effective Speed Factor : 2.659
Load-Life Factor : 7.63189

Expected Average Life : 1.28918 10⁷

=====

Ball number : 29
Ball angle : 70.
Ball position : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.2206
Residual Force Vector : {0.0380764, -0.115973, 0.00814673}
Displacement Residual : 4.98167 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.8661
Max Normal Stress : -237625.
Displacement : 0.000132703
Contact a-length : 0.019871
Contact b-length : 0.00241614
Contact area : 0.000150831
Distance to Corner : 0.0140599
Effective Speed Factor : 2.659
Load-Life Factor : 8.91308

Expected Average Life : 2.39825 10⁷

Contact name : DiCi
Max Normal Load : 12.9068
Max Normal Stress : -192993.
Displacement : 0.0000875391
Contact a-length : 0.0161391
Contact b-length : 0.00196244
Contact area : 0.0000995007
Distance to Corner: Dp : 0.0101109
Distance to Corner: Ds : 0.0101109
Effective Speed Factor : 2.659
Load-Life Factor : 16.4812

Expected Average Life : 2.80375 10⁸

Contact name : DsCo
Max Normal Load : 27.9331
Max Normal Stress : -250413.
Displacement : 0.000147393
Contact a-length : 0.0209419
Contact b-length : 0.00254664
Contact area : 0.000167546
Distance to Corner : 0.0129889
Effective Speed Factor : 2.659
Load-Life Factor : 7.61534

Expected Average Life : 1.27803 10⁷

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.128
Residual Force Vector : {0.0575248, -0.107654, 0.00793098}
Displacement Residual : 4.98977 10⁻⁷

Contact name : DpCi
Max Normal Load : 23.9395
Max Normal Stress : -237869.
Displacement : 0.000132976
Contact a-length : 0.0198913
Contact b-length : 0.00241862
Contact area : 0.000151141
Distance to Corner : 0.0140395
Effective Speed Factor : 2.659
Load-Life Factor : 8.88572

Expected Average Life : 2.36894 10⁷

Contact name : DiCi
Max Normal Load : 12.8977
Max Normal Stress : -192947.
Displacement : 0.000087497
Contact a-length : 0.0161352
Contact b-length : 0.00196197
Contact area : 0.0000994529
Distance to Corner: Dp : 0.0101148
Distance to Corner: Ds : 0.0101148
Effective Speed Factor : 2.659
Load-Life Factor : 16.4928

Expected Average Life : 2.81166 10⁸

Contact name : DsCo
Max Normal Load : 27.9934
Max Normal Stress : -250592.
Displacement : 0.000147604
Contact a-length : 0.0209569
Contact b-length : 0.00254846
Contact area : 0.000167786
Distance to Corner : 0.0129739
Effective Speed Factor : 2.659
Load-Life Factor : 7.59894

Expected Average Life : 1.26706 10⁷

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.0358
Residual Force Vector : {0.0752474, -0.096101, 0.00771997}

-7
Displacement Residual : 4.99778 10

Contact name : DpCi
Max Normal Load : 24.0128
Max Normal Stress : -238112.
Displacement : 0.000133247
Contact a-length : 0.0199116
Contact b-length : 0.00242109
Contact area : 0.000151449
Distance to Corner : 0.0140192
Effective Speed Factor : 2.659
Load-Life Factor : 8.85863

7
Expected Average Life : 2.34018 10

Contact name : DiCi
Max Normal Load : 12.8885
Max Normal Stress : -192900.
Displacement : 0.0000874541
Contact a-length : 0.0161312
Contact b-length : 0.00196149
Contact area : 0.0000994041
Distance to Corner: Dp : 0.0101188
Distance to Corner: Ds : 0.0101188
Effective Speed Factor : 2.659
Load-Life Factor : 16.5047

8
Expected Average Life : 2.81976 10

Contact name : DsCo
Max Normal Load : 28.0534
Max Normal Stress : -250771.
Displacement : 0.000147814
Contact a-length : 0.0209718
Contact b-length : 0.00255028
Contact area : 0.000168024
Distance to Corner : 0.0129591
Effective Speed Factor : 2.659
Load-Life Factor : 7.58269

7
Expected Average Life : 1.25625 10

=====

Ball number : 32
Ball angle : 40.
Ball position : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.944
Residual Force Vector : {0.0907111, -0.0816596, 0.00751358}

-7
Displacement Residual : 5.00572 10

Contact name : DpCi
Max Normal Load : 24.0857
Max Normal Stress : -238353.
Displacement : 0.000133517
Contact a-length : 0.0199318
Contact b-length : 0.00242354
Contact area : 0.000151756
Distance to Corner : 0.0139991
Effective Speed Factor : 2.659
Load-Life Factor : 8.83181

7
Expected Average Life : 2.31197 10

Contact name : DiCi
Max Normal Load : 12.879
Max Normal Stress : -192852.
Displacement : 0.0000874104
Contact a-length : 0.0161272
Contact b-length : 0.001961
Contact area : 0.0000993544
Distance to Corner: Dp : 0.0101228
Distance to Corner: Ds : 0.0101228
Effective Speed Factor : 2.659
Load-Life Factor : 16.5168

8
Expected Average Life : 2.82805 10

Contact name : DsCo
Max Normal Load : 28.1131
Max Normal Stress : -250948.
Displacement : 0.000148023
Contact a-length : 0.0209866
Contact b-length : 0.00255208
Contact area : 0.000168262
Distance to Corner : 0.0129442
Effective Speed Factor : 2.659
Load-Life Factor : 7.56658

7
Expected Average Life : 1.24561 10


```
=====
Ball number      : 33
Ball angle       : 30.
Ball position    : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 27.8526
Residual Force Vector : {0.10345, -0.0647626, 0.00731166}
Displacement Residual : 5.01356 10
****
Contact name     : DpCi
Max Normal Load  : 24.1583
Max Normal Stress : -238592.
Displacement     : 0.000133785
Contact a-length : 0.0199518
Contact b-length : 0.00242597
Contact area     : 0.000152061
Distance to Corner : 0.013979
Effective Speed Factor : 2.659
Load-Life Factor : 8.80526
Expected Average Life : 2.28429 10
****
Contact name     : DiCi
Max Normal Load  : 12.8694
Max Normal Stress : -192802.
Displacement     : 0.0000873658
Contact a-length : 0.0161231
Contact b-length : 0.0019605
Contact area     : 0.0000993037
Distance to Corner: Dp : 0.0101269
Distance to Corner: Ds : 0.0101269
Effective Speed Factor : 2.659
Load-Life Factor : 16.5292
Expected Average Life : 2.83653 10
****
Contact name     : DsCo
Max Normal Load  : 28.1725
Max Normal Stress : -251124.
Displacement     : 0.000148231
Contact a-length : 0.0210013
Contact b-length : 0.00255387
Contact area     : 0.000168498
Distance to Corner : 0.0129295
Effective Speed Factor : 2.659
Load-Life Factor : 7.55062
Expected Average Life : 1.23514 10
```

```
=====
Ball number      : 34
Ball angle       : 20.
Ball position    : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 27.7615
Residual Force Vector : {0.11308, -0.0459167, 0.00711411}
Displacement Residual : 5.02131 10
****
Contact name     : DpCi
Max Normal Load  : 24.2306
Max Normal Stress : -238830.
Displacement     : 0.000134052
Contact a-length : 0.0199717
Contact b-length : 0.00242839
Contact area     : 0.000152364
Distance to Corner : 0.0139591
Effective Speed Factor : 2.659
Load-Life Factor : 8.77897
Expected Average Life : 2.25713 10
****
Contact name     : DiCi
Max Normal Load  : 12.8596
Max Normal Stress : -192752.
Displacement     : 0.0000873205
Contact a-length : 0.0161189
Contact b-length : 0.00195999
Contact area     : 0.0000992522
Distance to Corner: Dp : 0.0101311
Distance to Corner: Ds : 0.0101311
Effective Speed Factor : 2.659
Load-Life Factor : 16.5418
Expected Average Life : 2.8452 10
****
Contact name     : DsCo
Max Normal Load  : 28.2316
Max Normal Stress : -251298.
Displacement     : 0.000148437
Contact a-length : 0.0210159
Contact b-length : 0.00255564
Contact area     : 0.000168733
Distance to Corner : 0.0129149
Effective Speed Factor : 2.659
Load-Life Factor : 7.53481
Expected Average Life : 1.22482 10
```

=====

Ball number : 35
Ball angle : 10.
Ball position : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.6709
Residual Force Vector : {0.119311, -0.0256881, 0.0069208}
Displacement Residual : 5.02897 10⁻⁷

Contact name : DpCi
Max Normal Load : 24.3027
Max Normal Stress : -239067.
Displacement : 0.000134318
Contact a-length : 0.0199915
Contact b-length : 0.0024308
Contact area : 0.000152666
Distance to Corner : 0.0139394
Effective Speed Factor : 2.659
Load-Life Factor : 8.75294

Expected Average Life : 2.23048 10⁷

Contact name : DiCi
Max Normal Load : 12.8496
Max Normal Stress : -192701.
Displacement : 0.0000872743
Contact a-length : 0.0161146
Contact b-length : 0.00195947
Contact area : 0.0000991997
Distance to Corner: Dp : 0.0101354
Distance to Corner: Ds : 0.0101354
Effective Speed Factor : 2.659
Load-Life Factor : 16.5547

Expected Average Life : 2.85406 10⁸

Contact name : DsCo
Max Normal Load : 28.2905
Max Normal Stress : -251472.
Displacement : 0.000148643
Contact a-length : 0.0210305
Contact b-length : 0.00255741
Contact area : 0.000168966
Distance to Corner : 0.0129004
Effective Speed Factor : 2.659
Load-Life Factor : 7.51914

Expected Average Life : 1.21466 10⁷

=====

Ball number : 36
Ball angle : 0.
Ball position : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 34.1912
Residual Force Vector : {0.640099, 0.0914643, -0.0435784}

Displacement Residual : 2.48938 10⁻⁶

Contact name : DpCo
Max Normal Load : 22.4786
Max Normal Stress : -233613.
Displacement : 0.000128272
Contact a-length : 0.0195364
Contact b-length : 0.00237563
Contact area : 0.000145805
Distance to Corner : 0.0143945
Effective Speed Factor : 2.659
Load-Life Factor : 9.46323

Expected Average Life : 3.04748 10⁷

Contact name : DiCi
Max Normal Load : 15.1244
Max Normal Stress : -201536.
Displacement : 0.0000954598
Contact a-length : 0.0168534
Contact b-length : 0.00204931
Contact area : 0.000108504
Distance to Corner: Dp : 0.00939659
Distance to Corner: Ds : 0.00939659
Effective Speed Factor : 2.659
Load-Life Factor : 14.0647

Expected Average Life : 1.48697 10⁸

Contact name : DsCi
Max Normal Load : 26.2531
Max Normal Stress : -245705.
Displacement : 0.000141872
Contact a-length : 0.020546
Contact b-length : 0.00249812
Contact area : 0.000161246
Distance to Corner : 0.0133848
Effective Speed Factor : 2.659
Load-Life Factor : 8.10265

Expected Average Life : 1.63792 10⁷

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.441531

Total Internal Loads (Fx,Fy,Fz)
 Primary Disk : {-338.471, 61.9504, -617.788}
 Intermediate Disk : {14.0308, -25.8057, -22.2235}
 Secondary Disk : {324.565, -41.1238, 640.902}

Total Axial Torque (Tz)
 Primary Disk : 31.9252
 Intermediate Disk : 1197.03
 Secondary Disk : -1199.99

Torque Ratio: Ds/Dp : 37.5876
 Torque Ratio: Di/Dp : 37.4949
 Torque Ratio: Di/Ds : 0.997534

Torsional Stiffness (T/rad) : 155718.

Average Residual Force : {-0.00344892, 0.138307, -0.0247179
 -6

Average Displacement Residual : 1.35503 10

Dp Speed : 10.
 Ds Speed : 0.27027
 Speed Conversion Ratio : 37.
 Effective N.D. Speed : 20.
 Minimum Expected Average Life : 20.
 hours : 2.23048 10
 years : 2546.21

Average Load-Life Factor: Dp : 9.34973
 Average Load-Life Factor: Di : 15.2908
 Average Load-Life Factor: Ds : 7.9515

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	:	-239067.
At ball number	:	35
Maximum Compressive Contact Stress Di	:	-201557.
At ball number	:	7
Maximum Compressive Contact Stress Ds	:	-245705.
At ball number	:	36
Maximum Ball Deflection Dp	:	0.000134318
At ball number	:	35
Maximum Ball Deflection Di	:	0.0000954798
At ball number	:	7
Maximum Ball Deflection Ds	:	0.000148643
At ball number	:	35
Maximum Ball Contact Area Dp	:	0.000152666
At ball number	:	35
Maximum Ball Contact Area Di	:	0.000108526
At ball number	:	7
Maximum Ball Contact Area Ds	:	0.000168966
At ball number	:	35
Maximum Ball a-patch Dp	:	0.0199915
At ball number	:	35
Maximum Ball a-patch Di	:	0.0168552
At ball number	:	7
Maximum Ball a-patch Ds	:	0.0210305
At ball number	:	35
Maximum Ball b-patch Dp	:	0.0024308
At ball number	:	35
Maximum Ball b-patch Di	:	0.00204952
At ball number	:	7
Maximum Ball b-patch Ds	:	0.00255741
At ball number	:	35
Minimum Distance to Dp Corner	:	0.0139394
At ball number	:	35
Minimum Distance to Di Corner: Dp	:	0.00939482
At ball number	:	7
Minimum Distance to Di Corner: Ds	:	0.00939482
At ball number	:	7
Minimum Distance to Ds Corner	:	0.0129004
At ball number	:	35

=====
=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 50 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter = 0.15625

ConformingDiameter = 0.1625

ConformingPercentage = 52.

PrimaryFlankAngleDegrees = 50.

IntermediateFlankAngleDegrees = 0.

SecondaryFlankAngleDegrees = 50.

PrimaryFractionBallDepth = 0.3

SecondaryFractionBallDepth = 0.3

ToleranceFraction = 0.01

ContactToCornerDistance for Dp = 0.0444894

ContactToCornerDistance for Ds = 0.0444894

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

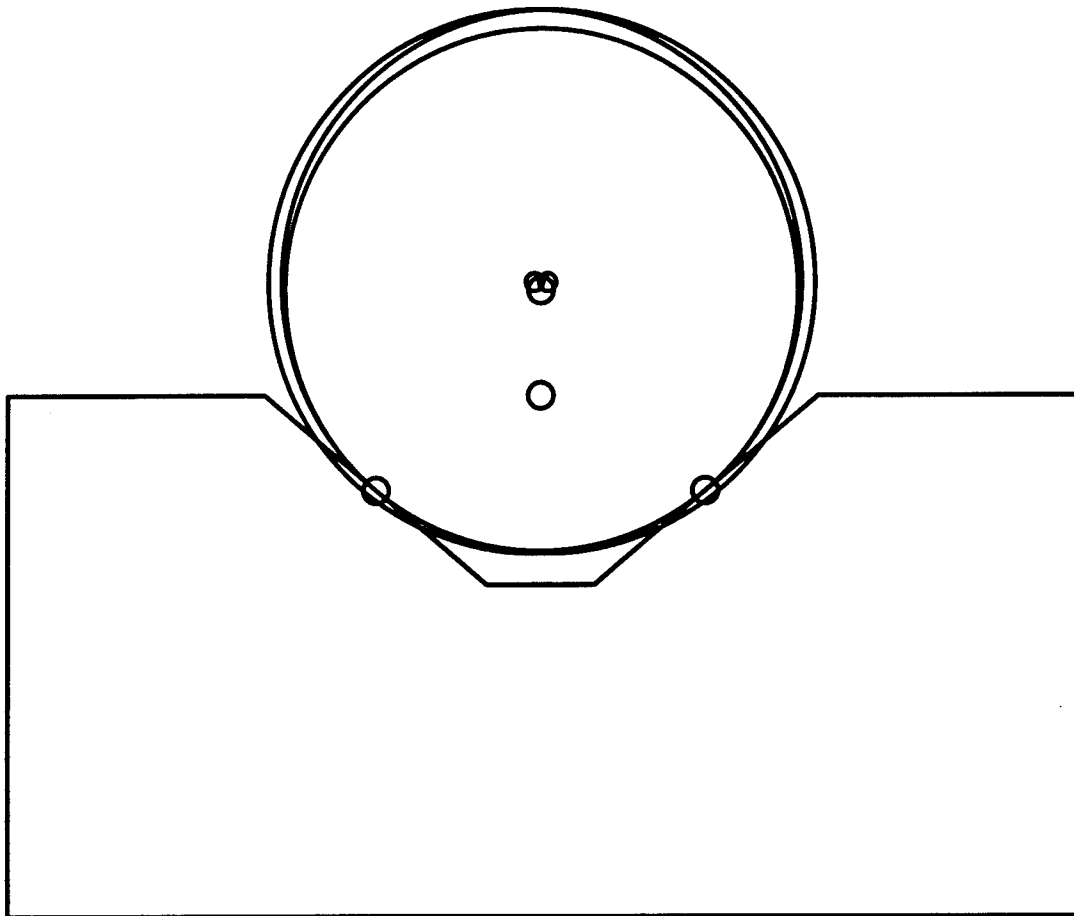
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ **2.0 Ball Race Section Profile**

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```
-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition      = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1
```

Summary of Kinematic Solver Results

```
-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta            = 1.
PrimaryAngleNumber           = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1
```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

```
=====
Summary of Stress and Displacement Calculations
=====
Calculated for kinematic solution : 6
Angular Deformation                : 0.506528
Applied Torque                     : 1199.91
```

=====

Ball number : 1
 Ball angle : 350.
 Ball position : {-0.21683, 2.47838, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.0786
 Residual Force Vector : {0.63446, 0.10761, 0.0739486}
 Displacement Residual : 2.34541 10⁻⁶

Contact name : DpCo
 Max Normal Load : 25.6215
 Max Normal Stress : -243615.
 Displacement : 0.000139492
 Contact a-length : 0.0203728
 Contact b-length : 0.00247734
 Contact area : 0.000158557
 Distance to Corner : 0.0241166
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.30241

Expected Average Life : 1.80551 10⁷

Contact name : DiCi
 Max Normal Load : 15.214
 Max Normal Stress : -202001.
 Displacement : 0.0000959007
 Contact a-length : 0.0168923
 Contact b-length : 0.00205403
 Contact area : 0.000109005
 Distance to Corner: Dp : 0.00935771
 Distance to Corner: Ds : 0.00935771
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.9818

Expected Average Life : 1.45225 10⁸

Contact name : DsCi
 Max Normal Load : 28.8803
 Max Normal Stress : -253767.
 Displacement : 0.000151335
 Contact a-length : 0.0212201
 Contact b-length : 0.00258008
 Contact area : 0.000172001
 Distance to Corner : 0.0232692
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.36557

Expected Average Life : 1.11843 10⁷

```
=====
Ball number      : 2
Ball angle       : 340.
Ball position    : {-0.640757, 2.39134, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 31.1588
Residual Force Vector : {0.598097, 0.214683, 0.0716419}
Displacement Residual : 2.31692 10-6
****
Contact name     : DpCo
Max Normal Load  : 25.5545
Max Normal Stress : -243403.
Displacement     : 0.000139248
Contact a-length : 0.020355
Contact b-length : 0.00247518
Contact area     : 0.000158281
Distance to Corner : 0.0241343
Effective Speed Factor : 2.659
Load-Life Factor : 8.32416
Expected Average Life : 1.82451 107
****
Contact name     : DiCi
Max Normal Load  : 15.2111
Max Normal Stress : -202018.
Displacement     : 0.000095917
Contact a-length : 0.0168937
Contact b-length : 0.00205421
Contact area     : 0.000109023
Distance to Corner: Dp : 0.00935627
Distance to Corner: Ds : 0.00935627
Effective Speed Factor : 2.659
Load-Life Factor : 13.9845
Expected Average Life : 1.45337 108
****
Contact name     : DsCi
Max Normal Load  : 28.8278
Max Normal Stress : -253604.
Displacement     : 0.000151141
Contact a-length : 0.0212066
Contact b-length : 0.00257843
Contact area     : 0.000171781
Distance to Corner : 0.0232828
Effective Speed Factor : 2.659
Load-Life Factor : 7.379
Expected Average Life : 1.12661 107
```

=====

Ball number : 3
 Ball angle : 330.
 Ball position : {-1.04114, 2.23273, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.2394
 Residual Force Vector : {0.54407, 0.312424, 0.0693453}

Displacement Residual : 2.28844 10

Contact name : DpCo
 Max Normal Load : 25.4873
 Max Normal Stress : -243189.
 Displacement : 0.000139004
 Contact a-length : 0.0203372
 Contact b-length : 0.002473
 Contact area : 0.000158003
 Distance to Corner : 0.0241522
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.34611

Expected Average Life : 1.84383 10

Contact name : DiCi
 Max Normal Load : 15.208
 Max Normal Stress : -202034.
 Displacement : 0.0000959326
 Contact a-length : 0.0168951
 Contact b-length : 0.00205437
 Contact area : 0.000109041
 Distance to Corner: Dp : 0.0093549
 Distance to Corner: Ds : 0.0093549
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.9874

Expected Average Life : 1.45455 10

Contact name : DsCi
 Max Normal Load : 28.775
 Max Normal Stress : -253441.
 Displacement : 0.000150947
 Contact a-length : 0.0211929
 Contact b-length : 0.00257677
 Contact area : 0.00017156
 Distance to Corner : 0.0232965
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.39253

Expected Average Life : 1.1349 10

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.3203
Residual Force Vector : {0.474509, 0.397995, 0.0670594}
Displacement Residual : 2.25997 10⁻⁶

Contact name : DpCo
Max Normal Load : 25.4199
Max Normal Stress : -242974.
Displacement : 0.000138758
Contact a-length : 0.0203192
Contact b-length : 0.00247082
Contact area : 0.000157724
Distance to Corner : 0.0241702
Effective Speed Factor : 2.659
Load-Life Factor : 8.36826

Expected Average Life : 1.86348 10⁷

Contact name : DiCi
Max Normal Load : 15.2047
Max Normal Stress : -202050.
Displacement : 0.0000959475
Contact a-length : 0.0168964
Contact b-length : 0.00205453
Contact area : 0.000109058
Distance to Corner: Dp : 0.00935359
Distance to Corner: Ds : 0.00935359
Effective Speed Factor : 2.659
Load-Life Factor : 13.9904

Expected Average Life : 1.4558 10⁸

Contact name : DsCi
Max Normal Load : 28.7219
Max Normal Stress : -253277.
Displacement : 0.000150751
Contact a-length : 0.0211792
Contact b-length : 0.0025751
Contact area : 0.000171338
Distance to Corner : 0.0233102
Effective Speed Factor : 2.659
Load-Life Factor : 7.40618

Expected Average Life : 1.1433 10⁷

=====

Ball number : 5
 Ball angle : 310.
 Ball position : {-1.7248, 1.7248, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.4015
 Residual Force Vector : {0.391982, 0.469012, 0.0647845}
 Displacement Residual : 2.23151 10⁻⁶

Contact name : DpCo
 Max Normal Load : 25.3521
 Max Normal Stress : -242758.
 Displacement : 0.000138511
 Contact a-length : 0.0203011
 Contact b-length : 0.00246862
 Contact area : 0.000157443
 Distance to Corner : 0.0241883
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.39061

Expected Average Life : 1.88347 10⁷

Contact name : DiCi
 Max Normal Load : 15.2013
 Max Normal Stress : -202065.
 Displacement : 0.0000959616
 Contact a-length : 0.0168976
 Contact b-length : 0.00205468
 Contact area : 0.000109074
 Distance to Corner: Dp : 0.00935235
 Distance to Corner: Ds : 0.00935235
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.9935

Expected Average Life : 1.45712 10⁸

Contact name : DsCi
 Max Normal Load : 28.6687
 Max Normal Stress : -253111.
 Displacement : 0.000150554
 Contact a-length : 0.0211653
 Contact b-length : 0.00257342
 Contact area : 0.000171114
 Distance to Corner : 0.023324
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.41995

Expected Average Life : 1.15183 10⁷

=====

Ball number : 6
 Ball angle : 300.
 Ball position : {-1.98815, 1.39212, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.483
 Residual Force Vector : {0.29941, 0.52361, 0.0625213}
 Displacement Residual : 2.20306 10⁻⁶

Contact name : DpCo
 Max Normal Load : 25.2842
 Max Normal Stress : -242541.
 Displacement : 0.000138263
 Contact a-length : 0.0202829
 Contact b-length : 0.00246641
 Contact area : 0.000157161
 Distance to Corner : 0.0242064
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.41316

Expected Average Life : 1.9038 10⁷

Contact name : DiCi
 Max Normal Load : 15.1977
 Max Normal Stress : -202079.
 Displacement : 0.000095975
 Contact a-length : 0.0168988
 Contact b-length : 0.00205483
 Contact area : 0.000109089
 Distance to Corner: Dp : 0.00935117
 Distance to Corner: Ds : 0.00935117
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.9969

Expected Average Life : 1.4585 10⁸

Contact name : DsCi
 Max Normal Load : 28.6151
 Max Normal Stress : -252945.
 Displacement : 0.000150357
 Contact a-length : 0.0211514
 Contact b-length : 0.00257173
 Contact area : 0.00017089
 Distance to Corner : 0.0233379
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.43384

Expected Average Life : 1.16047 10⁷

=====

Ball number : 7
Ball angle : 290.
Ball position : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.5649
Residual Force Vector : {0.199958, 0.560492, 0.0602703}
Displacement Residual : 2.17463 10⁻⁶

Contact name : DpCo
Max Normal Load : 25.216
Max Normal Stress : -242322.
Displacement : 0.000138014
Contact a-length : 0.0202647
Contact b-length : 0.00246418
Contact area : 0.000156878
Distance to Corner : 0.0242247
Effective Speed Factor : 2.659
Load-Life Factor : 8.43592

Expected Average Life : 1.92448 10⁷

Contact name : DiCi
Max Normal Load : 15.1939
Max Normal Stress : -202092.
Displacement : 0.0000959876
Contact a-length : 0.0168999
Contact b-length : 0.00205496
Contact area : 0.000109104
Distance to Corner: Dp : 0.00935006
Distance to Corner: Ds : 0.00935006
Effective Speed Factor : 2.659
Load-Life Factor : 14.0003

Expected Average Life : 1.45995 10⁸

Contact name : DsCi
Max Normal Load : 28.5613
Max Normal Stress : -252778.
Displacement : 0.000150158
Contact a-length : 0.0211375
Contact b-length : 0.00257003
Contact area : 0.000170664
Distance to Corner : 0.0233519
Effective Speed Factor : 2.659
Load-Life Factor : 7.44784

Expected Average Life : 1.16924 10⁷

=====

Ball number : 8
Ball angle : 280.
Ball position : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 31.6471
Residual Force Vector : {0.0969321, 0.578956, 0.0580318}
Displacement Residual : 2.14621 10⁻⁶

Contact name : DpCo
Max Normal Load : 25.1475
Max Normal Stress : -242102.
Displacement : 0.000137764
Contact a-length : 0.0202463
Contact b-length : 0.00246195
Contact area : 0.000156593
Distance to Corner : 0.0242431
Effective Speed Factor : 2.659
Load-Life Factor : 8.45888

Expected Average Life : 1.94552 10⁷

Contact name : DiCi
Max Normal Load : 15.19
Max Normal Stress : -202105.
Displacement : 0.0000959995
Contact a-length : 0.016901
Contact b-length : 0.00205509
Contact area : 0.000109117
Distance to Corner: Dp : 0.00934901
Distance to Corner: Ds : 0.00934901
Effective Speed Factor : 2.659
Load-Life Factor : 14.004

Expected Average Life : 1.46146 10⁸

Contact name : DsCi
Max Normal Load : 28.5072
Max Normal Stress : -252610.
Displacement : 0.000149958
Contact a-length : 0.0211234
Contact b-length : 0.00256832
Contact area : 0.000170437
Distance to Corner : 0.023366
Effective Speed Factor : 2.659
Load-Life Factor : 7.46197

Expected Average Life : 1.17814 10⁷

=====

Ball number : 9
 Ball angle : 270.
 Ball position : {-2.38153, 0.208357, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.7297
 Residual Force Vector : {-0.00633267, 0.578903, 0.0558065}
 Displacement Residual : 2.11782 10⁻⁶

Contact name : DpCo
 Max Normal Load : 25.0788
 Max Normal Stress : -241881.
 Displacement : 0.000137513
 Contact a-length : 0.0202278
 Contact b-length : 0.0024597
 Contact area : 0.000156308
 Distance to Corner : 0.0242616
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.48205

Expected Average Life : 1.96692 10⁷

Contact name : DiCi
 Max Normal Load : 15.1859
 Max Normal Stress : -202116.
 Displacement : 0.0000960107
 Contact a-length : 0.016902
 Contact b-length : 0.00205521
 Contact area : 0.00010913
 Distance to Corner: Dp : 0.00934803
 Distance to Corner: Ds : 0.00934803
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.0078

Expected Average Life : 1.46304 10⁸

Contact name : DsCi
 Max Normal Load : 28.4529
 Max Normal Stress : -252441.
 Displacement : 0.000149758
 Contact a-length : 0.0211093
 Contact b-length : 0.0025666
 Contact area : 0.000170209
 Distance to Corner : 0.0233801
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.47621

Expected Average Life : 1.18716 10⁷

```

=====
Ball number      : 10
Ball angle       : 260.
Ball position     : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 31.8125
Residual Force Vector : {-0.106578, 0.560825, 0.0535949}
Displacement Residual : 2.08945 10-6
****
Contact name      : DpCo
Max Normal Load   : 25.0099
Max Normal Stress : -241659.
Displacement      : 0.00013726
Contact a-length  : 0.0202092
Contact b-length  : 0.00245744
Contact area      : 0.00015602
Distance to Corner : 0.0242802
Effective Speed Factor : 2.659
Load-Life Factor   : 8.50543
Expected Average Life : 1.9887 107
****
Contact name      : DiCi
Max Normal Load   : 15.1816
Max Normal Stress : -202127.
Displacement      : 0.000096021
Contact a-length  : 0.0169029
Contact b-length  : 0.00205532
Contact area      : 0.000109142
Distance to Corner: Dp : 0.00934712
Distance to Corner: Ds : 0.00934712
Effective Speed Factor : 2.659
Load-Life Factor   : 14.0117
Expected Average Life : 1.4647 108
****
Contact name      : DsCi
Max Normal Load   : 28.3983
Max Normal Stress : -252271.
Displacement      : 0.000149556
Contact a-length  : 0.021095
Contact b-length  : 0.00256487
Contact area      : 0.000169979
Distance to Corner : 0.0233944
Effective Speed Factor : 2.659
Load-Life Factor   : 7.49058
Expected Average Life : 1.19631 107

```

```
=====
Ball number      : 11
Ball angle       : 250.
Ball position     : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 31.8957
Residual Force Vector : {-0.200725, 0.525777, 0.0513974}
Displacement Residual : 2.06111 10
****
Contact name      : DpCo
Max Normal Load   : 24.9407
Max Normal Stress : -241436.
Displacement      : 0.000137006
Contact a-length  : 0.0201905
Contact b-length  : 0.00245516
Contact area      : 0.000155732
Distance to Corner : 0.0242989
Effective Speed Factor : 2.659
Load-Life Factor  : 8.52903
Expected Average Life : 2.01086 10
****
Contact name      : DiCi
Max Normal Load   : 15.1771
Max Normal Stress : -202137.
Displacement      : 0.0000960306
Contact a-length  : 0.0169037
Contact b-length  : 0.00205542
Contact area      : 0.000109152
Distance to Corner: Dp : 0.00934628
Distance to Corner: Ds : 0.00934628
Effective Speed Factor : 2.659
Load-Life Factor  : 14.0158
Expected Average Life : 1.46642 10
****
Contact name      : DsCi
Max Normal Load   : 28.3435
Max Normal Stress : -252099.
Displacement      : 0.000149353
Contact a-length  : 0.0210807
Contact b-length  : 0.00256313
Contact area      : 0.000169749
Distance to Corner : 0.0234087
Effective Speed Factor : 2.659
Load-Life Factor  : 7.50507
Expected Average Life : 1.2056 10
```

=====

Ball number : 12
 Ball angle : 240.
 Ball position : {-2.1336, -0.994914, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 31.9793
 Residual Force Vector : {-0.285973, 0.475326, 0.0492147}
 Displacement Residual : 2.0328 10⁻⁶

Contact name : DpCo
 Max Normal Load : 24.8713
 Max Normal Stress : -241211.
 Displacement : 0.000136751
 Contact a-length : 0.0201717
 Contact b-length : 0.00245288
 Contact area : 0.000155442
 Distance to Corner : 0.0243177
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.55284

Expected Average Life : 2.03341 10⁷

Contact name : DiCi
 Max Normal Load : 15.1725
 Max Normal Stress : -202147.
 Displacement : 0.0000960394
 Contact a-length : 0.0169045
 Contact b-length : 0.00205552
 Contact area : 0.000109162
 Distance to Corner: Dp : 0.0093455
 Distance to Corner: Ds : 0.0093455
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.0201

Expected Average Life : 1.46821 10⁸

Contact name : DsCi
 Max Normal Load : 28.2884
 Max Normal Stress : -251927.
 Displacement : 0.000149149
 Contact a-length : 0.0210663
 Contact b-length : 0.00256138
 Contact area : 0.000169517
 Distance to Corner : 0.023423
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.51969

Expected Average Life : 1.21502 10⁷

```

=====
Ball number      : 13
Ball angle       : 230.
Ball position    : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 32.0631
Residual Force Vector : {-0.359875, 0.411489, 0.0470471}
Displacement Residual : 2.00453 10-6
****
Contact name     : DpCo
Max Normal Load  : 24.8016
Max Normal Stress : -240985.
Displacement     : 0.000136495
Contact a-length : 0.0201528
Contact b-length : 0.00245058
Contact area     : 0.000155151
Distance to Corner : 0.0243366
Effective Speed Factor : 2.659
Load-Life Factor : 8.57687
Expected Average Life : 2.05636 107
****
Contact name     : DiCi
Max Normal Load  : 15.1677
Max Normal Stress : -202155.
Displacement     : 0.0000960474
Contact a-length : 0.0169052
Contact b-length : 0.0020556
Contact area     : 0.000109172
Distance to Corner: Dp : 0.0093448
Distance to Corner: Ds : 0.0093448
Effective Speed Factor : 2.659
Load-Life Factor : 14.0245
Expected Average Life : 1.47007 108
****
Contact name     : DsCi
Max Normal Load  : 28.233
Max Normal Stress : -251754.
Displacement     : 0.000148944
Contact a-length : 0.0210519
Contact b-length : 0.00255963
Contact area     : 0.000169284
Distance to Corner : 0.0234375
Effective Speed Factor : 2.659
Load-Life Factor : 7.53444
Expected Average Life : 1.22458 107

```

```

=====
Ball number      : 14
Ball angle       : 220.
Ball position    : {-1.64746, -1.64746, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 32.1474
Residual Force Vector : {-0.420417, 0.336657, 0.0448954}
Displacement Residual : 1.97629 10
****
Contact name     : DpCo
Max Normal Load  : 24.7317
Max Normal Stress : -240757.
Displacement     : 0.000136237
Contact a-length : 0.0201338
Contact b-length : 0.00244827
Contact area     : 0.000154858
Distance to Corner : 0.0243556
Effective Speed Factor : 2.659
Load-Life Factor : 8.60112
Expected Average Life : 2.07971 10
****
Contact name     : DiCi
Max Normal Load  : 15.1627
Max Normal Stress : -202162.
Displacement     : 0.0000960546
Contact a-length : 0.0169058
Contact b-length : 0.00205568
Contact area     : 0.00010918
Distance to Corner: Dp : 0.00934416
Distance to Corner: Ds : 0.00934416
Effective Speed Factor : 2.659
Load-Life Factor : 14.0292
Expected Average Life : 1.47201 10
****
Contact name     : DsCi
Max Normal Load  : 28.1774
Max Normal Stress : -251580.
Displacement     : 0.000148739
Contact a-length : 0.0210373
Contact b-length : 0.00255786
Contact area     : 0.00016905
Distance to Corner : 0.0234521
Effective Speed Factor : 2.659
Load-Life Factor : 7.54931
Expected Average Life : 1.23428 10

```


=====

Ball number : 15
 Ball angle : 210.
 Ball position : {-1.32938, -1.89856, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 32.2319
 Residual Force Vector : {-0.466064, 0.253506, 0.04276}
 Displacement Residual : 1.94809 10⁻⁶

Contact name : DpCo
 Max Normal Load : 24.6615
 Max Normal Stress : -240529.
 Displacement : 0.000135979
 Contact a-length : 0.0201147
 Contact b-length : 0.00244594
 Contact area : 0.000154564
 Distance to Corner : 0.0243747
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.62559

Expected Average Life : 2.10348 10⁷

Contact name : DiCi
 Max Normal Load : 15.1575
 Max Normal Stress : -202169.
 Displacement : 0.000096061
 Contact a-length : 0.0169064
 Contact b-length : 0.00205575
 Contact area : 0.000109187
 Distance to Corner: Dp : 0.0093436
 Distance to Corner: Ds : 0.0093436
 Effective Speed Factor : 2.659
 Load-Life Factor : 14.0339

Expected Average Life : 1.47402 10⁸

Contact name : DsCi
 Max Normal Load : 28.1215
 Max Normal Stress : -251405.
 Displacement : 0.000148532
 Contact a-length : 0.0210227
 Contact b-length : 0.00255608
 Contact area : 0.000168815
 Distance to Corner : 0.0234667
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.56431

Expected Average Life : 1.24412 10⁷

```
=====
Ball number      : 16
Ball angle       : 200.
Ball position    : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 32.3168
Residual Force Vector : {-0.495801, 0.164905, 0.0406414}
Displacement Residual : 1.91993 10-6
****
Contact name     : DpCo
Max Normal Load  : 24.5911
Max Normal Stress : -240299.
Displacement     : 0.000135719
Contact a-length : 0.0200955
Contact b-length : 0.0024436
Contact area     : 0.000154269
Distance to Corner : 0.0243939
Effective Speed Factor : 2.659
Load-Life Factor : 8.65028
Expected Average Life : 2.12767 107
****
Contact name     : DiCi
Max Normal Load  : 15.1522
Max Normal Stress : -202175.
Displacement     : 0.0000960665
Contact a-length : 0.0169069
Contact b-length : 0.00205581
Contact area     : 0.000109193
Distance to Corner: Dp : 0.00934311
Distance to Corner: Ds : 0.00934311
Effective Speed Factor : 2.659
Load-Life Factor : 14.0389
Expected Average Life : 1.4761 108
****
Contact name     : DsCi
Max Normal Load  : 28.0654
Max Normal Stress : -251229.
Displacement     : 0.000148324
Contact a-length : 0.0210079
Contact b-length : 0.00255429
Contact area     : 0.000168579
Distance to Corner : 0.0234814
Effective Speed Factor : 2.659
Load-Life Factor : 7.57944
Expected Average Life : 1.2541 107
```

```
=====
Ball number      : 17
Ball angle       : 190.
Ball position    : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 32.402
Residual Force Vector : {-0.509149, 0.0738156, 0.0385403}
Displacement Residual : 1.89182 10-6
****
Contact name     : DpCo
Max Normal Load  : 24.5205
Max Normal Stress : -240068.
Displacement     : 0.000135458
Contact a-length : 0.0200761
Contact b-length : 0.00244125
Contact area     : 0.000153972
Distance to Corner : 0.0244133
Effective Speed Factor : 2.659
Load-Life Factor : 8.6752
Expected Average Life : 2.1523 107
****
Contact name     : DiCi
Max Normal Load  : 15.1467
Max Normal Stress : -202180.
Displacement     : 0.0000960713
Contact a-length : 0.0169073
Contact b-length : 0.00205586
Contact area     : 0.000109199
Distance to Corner: Dp : 0.0093427
Distance to Corner: Ds : 0.0093427
Effective Speed Factor : 2.659
Load-Life Factor : 14.044
Expected Average Life : 1.47826 108
****
Contact name     : DsCi
Max Normal Load  : 28.009
Max Normal Stress : -251052.
Displacement     : 0.000148115
Contact a-length : 0.0209931
Contact b-length : 0.00255249
Contact area     : 0.000168341
Distance to Corner : 0.0234962
Effective Speed Factor : 2.659
Load-Life Factor : 7.59471
Expected Average Life : 1.26424 107
```

=====

Ball number : 18
Ball angle : 180.
Ball position : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 26.5514
Residual Force Vector : {-0.178167, 0.00978453, 0.00827376}

-7
Displacement Residual : 7.42278 10

Contact name : DpCi
Max Normal Load : 26.1134
Max Normal Stress : -244899.
Displacement : 0.000140952
Contact a-length : 0.0204792
Contact b-length : 0.00249011
Contact area : 0.000160207
Distance to Corner : 0.0240102
Effective Speed Factor : 2.659
Load-Life Factor : 8.146

7
Expected Average Life : 1.67325 10

Contact name : DiCi
Max Normal Load : 12.9665
Max Normal Stress : -193032.
Displacement : 0.0000875744
Contact a-length : 0.0161423
Contact b-length : 0.00196284
Contact area : 0.0000995408
Distance to Corner: Dp : 0.0101077
Distance to Corner: Ds : 0.0101077
Effective Speed Factor : 2.659
Load-Life Factor : 16.4054

8
Expected Average Life : 2.75249 10

Contact name : DsCo
Max Normal Load : 29.8775
Max Normal Stress : -256124.
Displacement : 0.000154192
Contact a-length : 0.0214194
Contact b-length : 0.00260471
Contact area : 0.000175274
Distance to Corner : 0.0230699
Effective Speed Factor : 2.659
Load-Life Factor : 7.11975

6
Expected Average Life : 9.76434 10

=====

Ball number : 19
Ball angle : 170.
Ball position : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 26.4638
Residual Force Vector : {-0.176128, -0.0210784, 0.00796297}

-7
Displacement Residual : 7.38873 10

Contact name : DpCi
Max Normal Load : 26.1895
Max Normal Stress : -245136.
Displacement : 0.000141225
Contact a-length : 0.020499
Contact b-length : 0.00249252
Contact area : 0.000160517
Distance to Corner : 0.0239904
Effective Speed Factor : 2.659
Load-Life Factor : 8.12233

7
Expected Average Life : 1.65389 10

Contact name : DiCi
Max Normal Load : 12.9563
Max Normal Stress : -192985.
Displacement : 0.0000875314
Contact a-length : 0.0161384
Contact b-length : 0.00196236
Contact area : 0.000099492
Distance to Corner: Dp : 0.0101116
Distance to Corner: Ds : 0.0101116
Effective Speed Factor : 2.659
Load-Life Factor : 16.4183

8
Expected Average Life : 2.76117 10

Contact name : DsCo
Max Normal Load : 29.9415
Max Normal Stress : -256305.
Displacement : 0.00015441
Contact a-length : 0.0214346
Contact b-length : 0.00260655
Contact area : 0.000175522
Distance to Corner : 0.0230548
Effective Speed Factor : 2.659
Load-Life Factor : 7.10452

6
Expected Average Life : 9.68107 10

=====

Ball number : 20
Ball angle : 160.
Ball position : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 26.3767
Residual Force Vector : {-0.168835, -0.0509537, 0.00766228}

-7
Displacement Residual : 7.35539 10

Contact name : DpCi
Max Normal Load : 26.2653
Max Normal Stress : -245371.
Displacement : 0.000141496
Contact a-length : 0.0205187
Contact b-length : 0.00249491
Contact area : 0.000160825
Distance to Corner : 0.0239707
Effective Speed Factor : 2.659
Load-Life Factor : 8.0989

7
Expected Average Life : 1.63489 10

Contact name : DiCi
Max Normal Load : 12.9459
Max Normal Stress : -192937.
Displacement : 0.0000874876
Contact a-length : 0.0161343
Contact b-length : 0.00196187
Contact area : 0.0000994421
Distance to Corner: Dp : 0.0101157
Distance to Corner: Ds : 0.0101157
Effective Speed Factor : 2.659
Load-Life Factor : 16.4314

8
Expected Average Life : 2.77003 10

Contact name : DsCo
Max Normal Load : 30.0052
Max Normal Stress : -256485.
Displacement : 0.000154627
Contact a-length : 0.0214496
Contact b-length : 0.00260838
Contact area : 0.000175769
Distance to Corner : 0.0230397
Effective Speed Factor : 2.659
Load-Life Factor : 7.08943

6
Expected Average Life : 9.59908 10

=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 26.2898
Residual Force Vector : {-0.156565, -0.078962, 0.00737127}

-7
Displacement Residual : 7.32273 10

Contact name : DpCi
Max Normal Load : 26.3408
Max Normal Stress : -245605.
Displacement : 0.000141766
Contact a-length : 0.0205383
Contact b-length : 0.00249729
Contact area : 0.000161132
Distance to Corner : 0.0239511
Effective Speed Factor : 2.659
Load-Life Factor : 8.07569

7
Expected Average Life : 1.61623 10

Contact name : DiCi
Max Normal Load : 12.9354
Max Normal Stress : -192887.
Displacement : 0.0000874429
Contact a-length : 0.0161302
Contact b-length : 0.00196137
Contact area : 0.0000993913
Distance to Corner: Dp : 0.0101198
Distance to Corner: Ds : 0.0101198
Effective Speed Factor : 2.659
Load-Life Factor : 16.4448

8
Expected Average Life : 2.77906 10

Contact name : DsCo
Max Normal Load : 30.0686
Max Normal Stress : -256664.
Displacement : 0.000154843
Contact a-length : 0.0214646
Contact b-length : 0.0026102
Contact area : 0.000176014
Distance to Corner : 0.0230248
Effective Speed Factor : 2.659
Load-Life Factor : 7.07448

6
Expected Average Life : 9.51834 10

```

=====
Ball number      : 22
Ball angle       : 140.
Ball position    : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 26.2033
Residual Force Vector : {-0.139736, -0.104289, 0.00708955}
                                     -7
Displacement Residual : 7.2907 10
****
Contact name     : DpCi
Max Normal Load  : 26.416
Max Normal Stress : -245838.
Displacement     : 0.000142035
Contact a-length : 0.0205577
Contact b-length : 0.00249966
Contact area     : 0.000161438
Distance to Corner : 0.0239316
Effective Speed Factor : 2.659
Load-Life Factor : 8.0527
                                     7
Expected Average Life : 1.5979 10
****
Contact name     : DiCi
Max Normal Load  : 12.9247
Max Normal Stress : -192837.
Displacement     : 0.0000873973
Contact a-length : 0.016126
Contact b-length : 0.00196085
Contact area     : 0.0000993395
Distance to Corner: Dp : 0.010124
Distance to Corner: Ds : 0.010124
Effective Speed Factor : 2.659
Load-Life Factor : 16.4584
                                     8
Expected Average Life : 2.78828 10
****
Contact name     : DsCo
Max Normal Load  : 30.1318
Max Normal Stress : -256841.
Displacement     : 0.000155058
Contact a-length : 0.0214795
Contact b-length : 0.00261201
Contact area     : 0.000176258
Distance to Corner : 0.0230099
Effective Speed Factor : 2.659
Load-Life Factor : 7.05966
                                     6
Expected Average Life : 9.43884 10

```



```

=====
Ball number      : 23
Ball angle       : 130.
Ball position    : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 26.1172
Residual Force Vector : {-0.118902, -0.126208, 0.00681675}
                                     -7
Displacement Residual : 7.25929 10
****
Contact name     : DpCi
Max Normal Load  : 26.4909
Max Normal Stress : -246069.
Displacement     : 0.000142302
Contact a-length : 0.0205771
Contact b-length : 0.00250201
Contact area     : 0.000161742
Distance to Corner : 0.0239123
Effective Speed Factor : 2.659
Load-Life Factor : 8.02993
                                     7
Expected Average Life : 1.57991 10
****
Contact name     : DiCi
Max Normal Load  : 12.9138
Max Normal Stress : -192786.
Displacement     : 0.0000873509
Contact a-length : 0.0161217
Contact b-length : 0.00196033
Contact area     : 0.0000992868
Distance to Corner: Dp : 0.0101283
Distance to Corner: Ds : 0.0101283
Effective Speed Factor : 2.659
Load-Life Factor : 16.4723
                                     8
Expected Average Life : 2.79768 10
****
Contact name     : DsCo
Max Normal Load  : 30.1946
Max Normal Stress : -257018.
Displacement     : 0.000155271
Contact a-length : 0.0214942
Contact b-length : 0.00261381
Contact area     : 0.000176501
Distance to Corner : 0.0229951
Effective Speed Factor : 2.659
Load-Life Factor : 7.04497
                                     6
Expected Average Life : 9.36054 10

```

=====

Ball number : 24
Ball angle : 120.
Ball position : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 26.0314
Residual Force Vector : {-0.0947272, -0.144101, 0.00655252}

-7

Displacement Residual : 7.22848 10

Contact name : DpCi
Max Normal Load : 26.5655
Max Normal Stress : -246300.
Displacement : 0.000142569
Contact a-length : 0.0205963
Contact b-length : 0.00250435
Contact area : 0.000162044
Distance to Corner : 0.0238931
Effective Speed Factor : 2.659
Load-Life Factor : 8.00738

7

Expected Average Life : 1.56223 10

Contact name : DiCi
Max Normal Load : 12.9028
Max Normal Stress : -192734.
Displacement : 0.0000873037
Contact a-length : 0.0161174
Contact b-length : 0.00195981
Contact area : 0.0000992332
Distance to Corner: Dp : 0.0101326
Distance to Corner: Ds : 0.0101326
Effective Speed Factor : 2.659
Load-Life Factor : 16.4864

8

Expected Average Life : 2.80726 10

Contact name : DsCo
Max Normal Load : 30.2571
Max Normal Stress : -257194.
Displacement : 0.000155483
Contact a-length : 0.0215089
Contact b-length : 0.0026156
Contact area : 0.000176742
Distance to Corner : 0.0229804
Effective Speed Factor : 2.659
Load-Life Factor : 7.03042

6

Expected Average Life : 9.28343 10

```
=====
Ball number      : 25
Ball angle       : 110.
Ball position    : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 25.946
Residual Force Vector : {-0.067968, -0.157476, 0.00629653}
                                     -7
Displacement Residual : 7.19822 10
****
Contact name      : DpCi
Max Normal Load   : 26.6398
Max Normal Stress : -246528.
Displacement      : 0.000142833
Contact a-length  : 0.0206155
Contact b-length  : 0.00250667
Contact area      : 0.000162345
Distance to Corner : 0.0238739
Effective Speed Factor : 2.659
Load-Life Factor  : 7.98504
                                     7
Expected Average Life : 1.54487 10
****
Contact name      : DiCi
Max Normal Load   : 12.8916
Max Normal Stress : -192681.
Displacement      : 0.0000872558
Contact a-length  : 0.0161129
Contact b-length  : 0.00195927
Contact area      : 0.0000991786
Distance to Corner: Dp : 0.0101371
Distance to Corner: Ds : 0.0101371
Effective Speed Factor : 2.659
Load-Life Factor  : 16.5007
                                     8
Expected Average Life : 2.81702 10
****
Contact name      : DsCo
Max Normal Load   : 30.3193
Max Normal Stress : -257368.
Displacement      : 0.000155695
Contact a-length  : 0.0215235
Contact b-length  : 0.00261737
Contact area      : 0.000176982
Distance to Corner : 0.0229658
Effective Speed Factor : 2.659
Load-Life Factor  : 7.016
                                     6
Expected Average Life : 9.20748 10
```

```
=====
Ball number      : 26
Ball angle       : 100.
Ball position    : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 25.8609
Residual Force Vector : {-0.0394514, -0.16598, 0.00604846}
                                     -7
Displacement Residual : 7.16852 10
****
Contact name      : DpCi
Max Normal Load   : 26.7138
Max Normal Stress : -246756.
Displacement      : 0.000143097
Contact a-length  : 0.0206345
Contact b-length  : 0.00250898
Contact area      : 0.000162645
Distance to Corner : 0.0238549
Effective Speed Factor : 2.659
Load-Life Factor  : 7.96292
                                     7
Expected Average Life : 1.52782 10
****
Contact name      : DiCi
Max Normal Load   : 12.8802
Max Normal Stress : -192627.
Displacement      : 0.000087207
Contact a-length  : 0.0161084
Contact b-length  : 0.00195872
Contact area      : 0.0000991231
Distance to Corner: Dp : 0.0101416
Distance to Corner: Ds : 0.0101416
Effective Speed Factor : 2.659
Load-Life Factor  : 16.5152
                                     8
Expected Average Life : 2.82696 10
****
Contact name      : DsCo
Max Normal Load   : 30.3812
Max Normal Stress : -257542.
Displacement      : 0.000155905
Contact a-length  : 0.0215381
Contact b-length  : 0.00261914
Contact area      : 0.000177221
Distance to Corner : 0.0229513
Effective Speed Factor : 2.659
Load-Life Factor  : 7.0017
                                     6
Expected Average Life : 9.13267 10
```

=====

Ball number : 27
Ball angle : 90.
Ball position : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.7762
Residual Force Vector : {-0.010048, -0.16941, 0.00580801}

-7
Displacement Residual : 7.13933 10

Contact name : DpCi
Max Normal Load : 26.7875
Max Normal Stress : -246982.
Displacement : 0.000143359
Contact a-length : 0.0206534
Contact b-length : 0.00251128
Contact area : 0.000162943
Distance to Corner : 0.023836
Effective Speed Factor : 2.659
Load-Life Factor : 7.94101

7
Expected Average Life : 1.51107 10

Contact name : DiCi
Max Normal Load : 12.8687
Max Normal Stress : -192572.
Displacement : 0.0000871574
Contact a-length : 0.0161038
Contact b-length : 0.00195816
Contact area : 0.0000990668
Distance to Corner: Dp : 0.0101462
Distance to Corner: Ds : 0.0101462
Effective Speed Factor : 2.659
Load-Life Factor : 16.53

8
Expected Average Life : 2.83709 10

Contact name : DsCo
Max Normal Load : 30.4428
Max Normal Stress : -257714.
Displacement : 0.000156114
Contact a-length : 0.0215525
Contact b-length : 0.00262089
Contact area : 0.000177458
Distance to Corner : 0.0229369
Effective Speed Factor : 2.659
Load-Life Factor : 6.98753

6
Expected Average Life : 9.05898 10

=====

Ball number : 28
Ball angle : 80.
Ball position : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.6918
Residual Force Vector : {0.0193535, -0.167714, 0.0055749}

Displacement Residual : 7.11064 10⁻⁷

Contact name : DpCi
Max Normal Load : 26.861
Max Normal Stress : -247206.
Displacement : 0.00014362
Contact a-length : 0.0206722
Contact b-length : 0.00251356
Contact area : 0.00016324
Distance to Corner : 0.0238172
Effective Speed Factor : 2.659
Load-Life Factor : 7.9193

Expected Average Life : 1.49462 10⁷

Contact name : DiCi
Max Normal Load : 12.8571
Max Normal Stress : -192517.
Displacement : 0.000087107
Contact a-length : 0.0160992
Contact b-length : 0.0019576
Contact area : 0.0000990096
Distance to Corner: Dp : 0.0101508
Distance to Corner: Ds : 0.0101508
Effective Speed Factor : 2.659
Load-Life Factor : 16.545

Expected Average Life : 2.8474 10⁸

Contact name : DsCo
Max Normal Load : 30.5041
Max Normal Stress : -257886.
Displacement : 0.000156321
Contact a-length : 0.0215668
Contact b-length : 0.00262263
Contact area : 0.000177694
Distance to Corner : 0.0229226
Effective Speed Factor : 2.659
Load-Life Factor : 6.97349

Expected Average Life : 8.98639 10⁶

```
=====
Ball number      : 29
Ball angle       : 70.
Ball position    : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 25.6077
Residual Force Vector : {0.0478733, -0.160995, 0.00534885}
Displacement Residual : 7.08242 10-7
****
Contact name     : DpCi
Max Normal Load  : 26.9341
Max Normal Stress : -247430.
Displacement     : 0.00014388
Contact a-length : 0.0206908
Contact b-length : 0.00251583
Contact area     : 0.000163535
Distance to Corner : 0.0237985
Effective Speed Factor : 2.659
Load-Life Factor : 7.8978
Expected Average Life : 1.47845 107
****
Contact name     : DiCi
Max Normal Load  : 12.8453
Max Normal Stress : -192460.
Displacement     : 0.0000870559
Contact a-length : 0.0160945
Contact b-length : 0.00195702
Contact area     : 0.0000989515
Distance to Corner: Dp : 0.0101555
Distance to Corner: Ds : 0.0101555
Effective Speed Factor : 2.659
Load-Life Factor : 16.5602
Expected Average Life : 2.8579 108
****
Contact name     : DsCo
Max Normal Load  : 30.5651
Max Normal Stress : -258056.
Displacement     : 0.000156528
Contact a-length : 0.0215811
Contact b-length : 0.00262437
Contact area     : 0.000177929
Distance to Corner : 0.0229083
Effective Speed Factor : 2.659
Load-Life Factor : 6.95958
Expected Average Life : 8.91487 106
```

=====

Ball number : 30
Ball angle : 60.
Ball position : {2.19968, 1.02573, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.524
Residual Force Vector : {0.0746663, -0.149503, 0.00512962}

-7
Displacement Residual : 7.05467 10

Contact name : DpCi
Max Normal Load : 27.0069
Max Normal Stress : -247652.
Displacement : 0.000144138
Contact a-length : 0.0207094
Contact b-length : 0.00251809
Contact area : 0.000163828
Distance to Corner : 0.02378
Effective Speed Factor : 2.659
Load-Life Factor : 7.8765

7
Expected Average Life : 1.46257 10

Contact name : DiCi
Max Normal Load : 12.8333
Max Normal Stress : -192403.
Displacement : 0.000087004
Contact a-length : 0.0160897
Contact b-length : 0.00195644
Contact area : 0.0000988925
Distance to Corner: Dp : 0.0101603
Distance to Corner: Ds : 0.0101603
Effective Speed Factor : 2.659
Load-Life Factor : 16.5757

8
Expected Average Life : 2.86858 10

Contact name : DsCo
Max Normal Load : 30.6258
Max Normal Stress : -258225.
Displacement : 0.000156733
Contact a-length : 0.0215952
Contact b-length : 0.00262609
Contact area : 0.000178163
Distance to Corner : 0.0228942
Effective Speed Factor : 2.659
Load-Life Factor : 6.94578

6
Expected Average Life : 8.84441 10

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.4406
Residual Force Vector : {0.0989467, -0.133629, 0.00491695}

-7
Displacement Residual : 7.02736 10

Contact name : DpCi
Max Normal Load : 27.0795
Max Normal Stress : -247873.
Displacement : 0.000144395
Contact a-length : 0.0207279
Contact b-length : 0.00252034
Contact area : 0.00016412
Distance to Corner : 0.0237615
Effective Speed Factor : 2.659
Load-Life Factor : 7.8554

7
Expected Average Life : 1.44696 10

Contact name : DiCi
Max Normal Load : 12.8212
Max Normal Stress : -192345.
Displacement : 0.0000869514
Contact a-length : 0.0160848
Contact b-length : 0.00195585
Contact area : 0.0000988327
Distance to Corner: Dp : 0.0101652
Distance to Corner: Ds : 0.0101652
Effective Speed Factor : 2.659
Load-Life Factor : 16.5913

8
Expected Average Life : 2.87944 10

Contact name : DsCo
Max Normal Load : 30.6862
Max Normal Stress : -258394.
Displacement : 0.000156938
Contact a-length : 0.0216093
Contact b-length : 0.0026278
Contact area : 0.000178395
Distance to Corner : 0.0228801
Effective Speed Factor : 2.659
Load-Life Factor : 6.93211

6
Expected Average Life : 8.77499 10

=====

Ball number : 32
Ball angle : 40.
Ball position : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.3576
Residual Force Vector : {0.120011, -0.113892, 0.00471061}

-7
Displacement Residual : 7.00047 10

Contact name : DpCi
Max Normal Load : 27.1517
Max Normal Stress : -248092.
Displacement : 0.000144651
Contact a-length : 0.0207462
Contact b-length : 0.00252257
Contact area : 0.000164411
Distance to Corner : 0.0237432
Effective Speed Factor : 2.659
Load-Life Factor : 7.8345

7
Expected Average Life : 1.43163 10

Contact name : DiCi
Max Normal Load : 12.8089
Max Normal Stress : -192286.
Displacement : 0.000086898
Contact a-length : 0.0160799
Contact b-length : 0.00195525
Contact area : 0.000098772
Distance to Corner: Dp : 0.0101701
Distance to Corner: Ds : 0.0101701
Effective Speed Factor : 2.659
Load-Life Factor : 16.6072

8
Expected Average Life : 2.89049 10

Contact name : DsCo
Max Normal Load : 30.7463
Max Normal Stress : -258561.
Displacement : 0.000157141
Contact a-length : 0.0216233
Contact b-length : 0.0026295
Contact area : 0.000178626
Distance to Corner : 0.0228661
Effective Speed Factor : 2.659
Load-Life Factor : 6.91856

6
Expected Average Life : 8.70658 10

=====

Ball number : 33
Ball angle : 30.
Ball position : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.275
Residual Force Vector : {0.137259, -0.0909208, 0.00451038}
Displacement Residual : 6.97398 10⁻⁷

Contact name : DpCi
Max Normal Load : 27.2236
Max Normal Stress : -248310.
Displacement : 0.000144906
Contact a-length : 0.0207645
Contact b-length : 0.00252478
Contact area : 0.0001647
Distance to Corner : 0.0237249
Effective Speed Factor : 2.659
Load-Life Factor : 7.8138

Expected Average Life : 1.41655 10⁷

Contact name : DiCi
Max Normal Load : 12.7965
Max Normal Stress : -192226.
Displacement : 0.000086844
Contact a-length : 0.0160749
Contact b-length : 0.00195464
Contact area : 0.0000987105
Distance to Corner: Dp : 0.0101751
Distance to Corner: Ds : 0.0101751
Effective Speed Factor : 2.659
Load-Life Factor : 16.6233

Expected Average Life : 2.90173 10⁸

Contact name : DsCo
Max Normal Load : 30.8061
Max Normal Stress : -258727.
Displacement : 0.000157343
Contact a-length : 0.0216372
Contact b-length : 0.00263119
Contact area : 0.000178856
Distance to Corner : 0.0228522
Effective Speed Factor : 2.659
Load-Life Factor : 6.90514

Expected Average Life : 8.63918 10⁶

```
=====
Ball number      : 34
Ball angle       : 20.
Ball position    : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request     : solve
Cross over angle  : 25.1926
Residual Force Vector : {0.15021, -0.0654343, 0.00431605}
                                     -7
Displacement Residual : 6.94788 10
****
Contact name      : DpCi
Max Normal Load   : 27.2953
Max Normal Stress : -248527.
Displacement      : 0.000145159
Contact a-length  : 0.0207826
Contact b-length  : 0.00252699
Contact area      : 0.000164988
Distance to Corner : 0.0237068
Effective Speed Factor : 2.659
Load-Life Factor  : 7.7933
                                     7
Expected Average Life : 1.40174 10
****
Contact name      : DiCi
Max Normal Load   : 12.7839
Max Normal Stress : -192165.
Displacement      : 0.0000867892
Contact a-length  : 0.0160698
Contact b-length  : 0.00195402
Contact area      : 0.0000986482
Distance to Corner: Dp : 0.0101802
Distance to Corner: Ds : 0.0101802
Effective Speed Factor : 2.659
Load-Life Factor  : 16.6397
                                     8
Expected Average Life : 2.91315 10
****
Contact name      : DsCo
Max Normal Load   : 30.8656
Max Normal Stress : -258892.
Displacement      : 0.000157544
Contact a-length  : 0.021651
Contact b-length  : 0.00263287
Contact area      : 0.000179084
Distance to Corner : 0.0228384
Effective Speed Factor : 2.659
Load-Life Factor  : 6.89182
                                     6
Expected Average Life : 8.57275 10
```

=====

Ball number : 35
Ball angle : 10.
Ball position : {0.643902, 2.40308, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 25.1106
Residual Force Vector : {0.158515, -0.0382212, 0.00412741}
Displacement Residual : 6.92215 10⁻⁷

Contact name : DpCi
Max Normal Load : 27.3666
Max Normal Stress : -248743.
Displacement : 0.000145411
Contact a-length : 0.0208006
Contact b-length : 0.00252918
Contact area : 0.000165275
Distance to Corner : 0.0236888
Effective Speed Factor : 2.659
Load-Life Factor : 7.77298

Expected Average Life : 1.38718 10⁷

Contact name : DiCi
Max Normal Load : 12.7712
Max Normal Stress : -192104.
Displacement : 0.0000867336
Contact a-length : 0.0160647
Contact b-length : 0.0019534
Contact area : 0.0000985851
Distance to Corner: Dp : 0.0101853
Distance to Corner: Ds : 0.0101853
Effective Speed Factor : 2.659
Load-Life Factor : 16.6562

Expected Average Life : 2.92476 10⁸

Contact name : DsCo
Max Normal Load : 30.9248
Max Normal Stress : -259056.
Displacement : 0.000157744
Contact a-length : 0.0216647
Contact b-length : 0.00263454
Contact area : 0.000179312
Distance to Corner : 0.0228247
Effective Speed Factor : 2.659
Load-Life Factor : 6.87863

Expected Average Life : 8.50729 10⁶

=====

Ball number : 36
 Ball angle : 0.
 Ball position : {0.217889, 2.49049, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 30.9987
 Residual Force Vector : {0.651554, -0.00558584, 0.0762651}
 Displacement Residual : 2.37389 10⁻⁶

Contact name : DpCo
 Max Normal Load : 25.6882
 Max Normal Stress : -243827.
 Displacement : 0.000139734
 Contact a-length : 0.0203905
 Contact b-length : 0.00247949
 Contact area : 0.000158833
 Distance to Corner : 0.0240989
 Effective Speed Factor : 2.659
 Load-Life Factor : 8.28085

Expected Average Life : 1.78683 10⁷

Contact name : DiCi
 Max Normal Load : 15.2168
 Max Normal Stress : -201983.
 Displacement : 0.0000958837
 Contact a-length : 0.0168908
 Contact b-length : 0.00205385
 Contact area : 0.000108986
 Distance to Corner: Dp : 0.00935921
 Distance to Corner: Ds : 0.00935921
 Effective Speed Factor : 2.659
 Load-Life Factor : 13.9793

Expected Average Life : 1.45119 10⁸

Contact name : DsCi
 Max Normal Load : 28.9326
 Max Normal Stress : -253928.
 Displacement : 0.000151528
 Contact a-length : 0.0212336
 Contact b-length : 0.00258173
 Contact area : 0.00017222
 Distance to Corner : 0.0232557
 Effective Speed Factor : 2.659
 Load-Life Factor : 7.35227

Expected Average Life : 1.11037 10⁷

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.506528

Total Internal Loads (Fx,Fy,Fz)
Primary Disk : {-345.358, 63.6729, -753.367}
Intermediate Disk : {15.3783, -27.9778, -19.827}
Secondary Disk : {329.283, -40.3065, 772.057}

Total Axial Torque (Tz)
Primary Disk : 32.2415
Intermediate Disk : 1200.08
Secondary Disk : -1199.91

Torque Ratio: Ds/Dp : 37.2163
Torque Ratio: Di/Dp : 37.2217
Torque Ratio: Di/Ds : 1.00014

Torsional Stiffness (T/rad) : 135728.

Average Residual Force : {0.0193435, 0.128095, 0.0315634}
Average Displacement Residual : 1.4242 10⁻⁶

Dp Speed : 10.
Ds Speed : 0.27027
Speed Conversion Ratio : 37.
Effective N.D. Speed : 20.
Minimum Expected Average Life : 20.
hours : 1.38718 10⁷
years : 1583.54

Average Load-Life Factor: Dp : 8.21401
Average Load-Life Factor: Di : 15.2668
Average Load-Life Factor: Ds : 7.23351

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	: -248743.
At ball number	: 35
Maximum Compressive Contact Stress Di	: -202180.
At ball number	: 17
Maximum Compressive Contact Stress Ds	: -253928.
At ball number	: 36
Maximum Ball Deflection Dp	: 0.000145411
At ball number	: 35
Maximum Ball Deflection Di	: 0.0000960713
At ball number	: 17
Maximum Ball Deflection Ds	: 0.000157744
At ball number	: 35
Maximum Ball Contact Area Dp	: 0.000165275
At ball number	: 35
Maximum Ball Contact Area Di	: 0.000109199
At ball number	: 17
Maximum Ball Contact Area Ds	: 0.000179312
At ball number	: 35
Maximum Ball a-patch Dp	: 0.0208006
At ball number	: 35
Maximum Ball a-patch Di	: 0.0169073
At ball number	: 17
Maximum Ball a-patch Ds	: 0.0216647
At ball number	: 35
Maximum Ball b-patch Dp	: 0.00252918
At ball number	: 35
Maximum Ball b-patch Di	: 0.00205586
At ball number	: 17
Maximum Ball b-patch Ds	: 0.00263454
At ball number	: 35
Minimum Distance to Dp Corner	: 0.0236888
At ball number	: 35
Minimum Distance to Di Corner: Dp	: 0.0093427
At ball number	: 17
Minimum Distance to Di Corner: Ds	: 0.0093427
At ball number	: 17
Minimum Distance to Ds Corner	: 0.0228247
At ball number	: 35

=====
=====

SYNKdrive™ Speed Conversion Technology

Analytical and Numerical Results

Precision Speed Reducer for Robotics and Manufacturing (TRP-93-009)

Conforming Race Design

Conforming Percentage: 52%

Flank Angle: 55 degrees

Applied Torque: 1200 in-lbs

■ 1.0 Geometric Definition

Summary of Conforming Race Parameters

BallDiameter	= 0.15625
ConformingDiameter	= 0.1625
ConformingPercentage	= 52.
PrimaryFlankAngleDegrees	= 55.
IntermediateFlankAngleDegrees	= 0.
SecondaryFlankAngleDegrees	= 55.
PrimaryFractionBallDepth	= 0.3
SecondaryFractionBallDepth	= 0.3
ToleranceFraction	= 0.01
ContactToCornerDistance for Dp	= 0.0570914
ContactToCornerDistance for Ds	= 0.0570914

Summary of Primary Disk Parameters

PrimaryDiskThickness = 0.5
PrimaryDiskDiameter = 6.

PrimaryRadiusMax = 2.5
PrimaryRadiusMin = 2.28125
PrimaryDisplacement = 0.21875

PrimaryPhiIncrement = 180.
PrimaryNumberLobes = 1

Summary of Intermediate Disk Parameters

IntermediateDiskThickness = 0.0525
IntermediateDiskDiameter = 6.

IntermediateRadiusMax = 2.5
IntermediateRadiusMin = 2.28125
IntermediateDisplacement = 0.21875
IntermediateSlotWidth = 0.15625

IntermediateTotalSlots = 36
IntermediateGammaIncrement = 10.

Summary of Secondary Disk Parameters

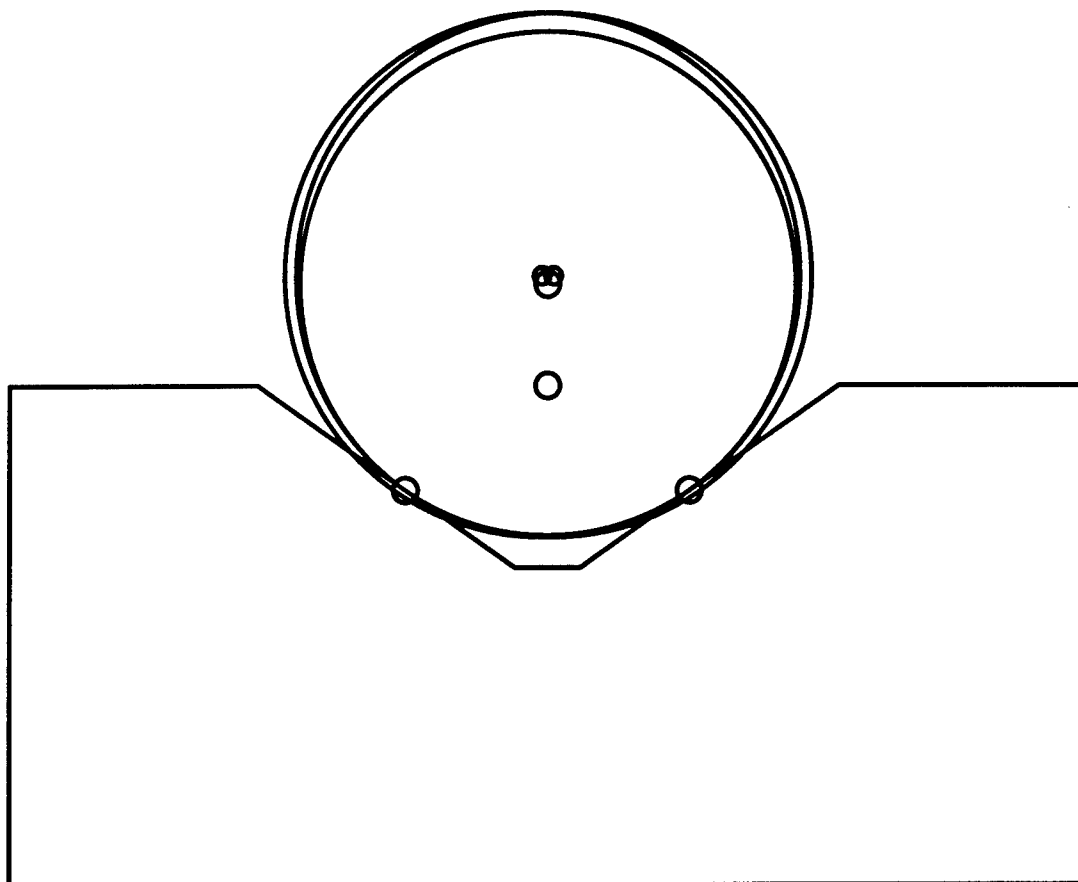
SecondaryDiskThickness = 0.5
SecondaryDiskDiameter = 6.

SecondaryRadiusMax = 2.5
SecondaryRadiusMin = 2.28125
SecondaryDisplacement = 0.21875

SecondaryPhiIncrement = 4.86486
SecondaryNumberLobes = 37

■ 2.0 Ball Race Section Profile

Primary and Secondary Race Profiles



■ 3.0 Constraints and Kinematic Results

Summary of Drive Constraint Parameters

```

-----
PrimaryNumberLobes           = 1
SecondaryNumberLobes         = 37
IntermediateTotalSlots       = 36 (requested balls)

BallConjugateDirection       = forward drive
BallConstraintCondition       = exactly constrained

Conjugate constraints         = 36
Forward drive condition      = 36
Reverser drive condition     = 38
Predicted speed ratio        = 37 to 1

```

Summary of Kinematic Solver Results

```

-----
PrimaryAngleStart            = 0.
PrimaryAngleFinish           = 5.
PrimaryAngleDelta             = 1.
PrimaryAngleNumber            = 6.
Speed Conversion Ratio (Dp:Ds) = 37. to 1

```

PrimaryDiskDeltaAngle:

Step	Dp Angle	Ds Angle
----	-----	-----
		-17
1	0.	2.77556 10
2	1.	0.027027
3	2.	0.0540541
4	3.	0.0810811
5	4.	0.108108
6	5.	0.135135

■ 4.0 Numerical Results

Summary of Stress and Displacement Calculations

```

=====
Calculated for kinematic solution : 6
Angular Deformation                : 0.599969
Applied Torque                     : 1199.24

```

=====

Ball number : 1
Ball angle : 350.
Ball position : {-0.21683, 2.47838, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.6614
Residual Force Vector : {0.572475, 0.0213365, 0.194516}

-6
Displacement Residual : 1.9945 10

Contact name : DpCo
Max Normal Load : 29.7361
Max Normal Stress : -255642.
Displacement : 0.000153604
Contact a-length : 0.0213786
Contact b-length : 0.00259964
Contact area : 0.000174599
Distance to Corner : 0.0357128
Effective Speed Factor : 2.659
Load-Life Factor : 7.15359

6
Expected Average Life : 9.95133 10

Contact name : DiCi
Max Normal Load : 15.2225
Max Normal Stress : -202376.
Displacement : 0.0000962575
Contact a-length : 0.0169237
Contact b-length : 0.00205785
Contact area : 0.00010941
Distance to Corner: Dp : 0.00932631
Distance to Corner: Ds : 0.00932631
Effective Speed Factor : 2.659
Load-Life Factor : 13.974

8
Expected Average Life : 1.44901 10

Contact name : DsCi
Max Normal Load : 32.4625
Max Normal Stress : -263869.
Displacement : 0.000163624
Contact a-length : 0.0220649
Contact b-length : 0.00268279
Contact area : 0.000185968
Distance to Corner : 0.0350265
Effective Speed Factor : 2.659
Load-Life Factor : 6.5528

6
Expected Average Life : 7.00635 10

=====

Ball number : 2
Ball angle : 340.
Ball position : {-0.640757, 2.39134, 0.)
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.7324
Residual Force Vector : {0.553606, 0.119475, 0.192111}

-6
Displacement Residual : 1.97085 10

Contact name : DpCo
Max Normal Load : 29.6676
Max Normal Stress : -255446.
Displacement : 0.000153368
Contact a-length : 0.0213622
Contact b-length : 0.00259764
Contact area : 0.000174331
Distance to Corner : 0.0357292
Effective Speed Factor : 2.659
Load-Life Factor : 7.17012

7
Expected Average Life : 1.00436 10

Contact name : DiCi
Max Normal Load : 15.2231
Max Normal Stress : -202403.
Displacement : 0.0000962836
Contact a-length : 0.016926
Contact b-length : 0.00205813
Contact area : 0.00010944
Distance to Corner: Dp : 0.00932403
Distance to Corner: Ds : 0.00932403
Effective Speed Factor : 2.659
Load-Life Factor : 13.9735

8
Expected Average Life : 1.4488 10

Contact name : DsCi
Max Normal Load : 32.4071
Max Normal Stress : -263712.
Displacement : 0.00016343
Contact a-length : 0.0220518
Contact b-length : 0.0026812
Contact area : 0.000185748
Distance to Corner : 0.0350396
Effective Speed Factor : 2.659
Load-Life Factor : 6.56398

6
Expected Average Life : 7.0543 10

=====

Ball number : 3
Ball angle : 330.
Ball position : {-1.04114, 2.23273, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.8037
Residual Force Vector : {0.518236, 0.211726, 0.189704}

-6
Displacement Residual : 1.9472 10

Contact name : DpCo
Max Normal Load : 29.5987
Max Normal Stress : -255248.
Displacement : 0.000153131
Contact a-length : 0.0213457
Contact b-length : 0.00259563
Contact area : 0.000174061
Distance to Corner : 0.0357457
Effective Speed Factor : 2.659
Load-Life Factor : 7.1868

7
Expected Average Life : 1.01374 10

Contact name : DiCi
Max Normal Load : 15.2235
Max Normal Stress : -202430.
Displacement : 0.0000963089
Contact a-length : 0.0169282
Contact b-length : 0.0020584
Contact area : 0.000109469
Distance to Corner: Dp : 0.0093218
Distance to Corner: Ds : 0.0093218
Effective Speed Factor : 2.659
Load-Life Factor : 13.9732

8
Expected Average Life : 1.44865 10

Contact name : DsCi
Max Normal Load : 32.3516
Max Normal Stress : -263555.
Displacement : 0.000163235
Contact a-length : 0.0220386
Contact b-length : 0.0026796
Contact area : 0.000185526
Distance to Corner : 0.0350527
Effective Speed Factor : 2.659
Load-Life Factor : 6.57526

6
Expected Average Life : 7.10289 10

=====

Ball number : 4
Ball angle : 320.
Ball position : {-1.40606, 2.00806, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.8753
Residual Force Vector : {0.46783, 0.295375, 0.187295}
Displacement Residual : 1.92353 10⁻⁶

Contact name : DpCo
Max Normal Load : 29.5296
Max Normal Stress : -255050.
Displacement : 0.000152893
Contact a-length : 0.021329
Contact b-length : 0.00259361
Contact area : 0.000173791
Distance to Corner : 0.0357623
Effective Speed Factor : 2.659
Load-Life Factor : 7.20361

7

Expected Average Life : 1.02326 10

Contact name : DiCi
Max Normal Load : 15.2237
Max Normal Stress : -202456.
Displacement : 0.0000963336
Contact a-length : 0.0169304
Contact b-length : 0.00205866
Contact area : 0.000109497
Distance to Corner: Dp : 0.00931962
Distance to Corner: Ds : 0.00931962
Effective Speed Factor : 2.659
Load-Life Factor : 13.9729

8

Expected Average Life : 1.44855 10

Contact name : DsCi
Max Normal Load : 32.2957
Max Normal Stress : -263397.
Displacement : 0.000163039
Contact a-length : 0.0220254
Contact b-length : 0.00267799
Contact area : 0.000185303
Distance to Corner : 0.0350659
Effective Speed Factor : 2.659
Load-Life Factor : 6.58663

6

Expected Average Life : 7.15214 10

=====

Ball number : 5
Ball angle : 310.
Ball position : {-1.7248, 1.7248, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 27.9472
Residual Force Vector : {0.404291, 0.368033, 0.184884}

-6
Displacement Residual : 1.89985 10

Contact name : DpCo
Max Normal Load : 29.4602
Max Normal Stress : -254850.
Displacement : 0.000152654
Contact a-length : 0.0213124
Contact b-length : 0.00259158
Contact area : 0.000173519
Distance to Corner : 0.035779
Effective Speed Factor : 2.659
Load-Life Factor : 7.22058

7
Expected Average Life : 1.03293 10

Contact name : DiCi
Max Normal Load : 15.2238
Max Normal Stress : -202481.
Displacement : 0.0000963577
Contact a-length : 0.0169325
Contact b-length : 0.00205892
Contact area : 0.000109524
Distance to Corner: Dp : 0.00931751
Distance to Corner: Ds : 0.00931751
Effective Speed Factor : 2.659
Load-Life Factor : 13.9729

8
Expected Average Life : 1.44852 10

Contact name : DsCi
Max Normal Load : 32.2396
Max Normal Stress : -263238.
Displacement : 0.000162842
Contact a-length : 0.0220121
Contact b-length : 0.00267638
Contact area : 0.00018508
Distance to Corner : 0.0350793
Effective Speed Factor : 2.659
Load-Life Factor : 6.59809

6
Expected Average Life : 7.20205 10

=====

Ball number : 6
Ball angle : 300.
Ball position : {-1.98815, 1.39212, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.0194
Residual Force Vector : {0.329888, 0.427712, 0.182472}

Displacement Residual : 1.87617 10⁻⁶

Contact name : DpCo
Max Normal Load : 29.3906
Max Normal Stress : -254650.
Displacement : 0.000152414
Contact a-length : 0.0212956
Contact b-length : 0.00258954
Contact area : 0.000173245
Distance to Corner : 0.0357958
Effective Speed Factor : 2.659
Load-Life Factor : 7.23769

Expected Average Life : 1.04276 10⁷

Contact name : DiCi
Max Normal Load : 15.2237
Max Normal Stress : -202506.
Displacement : 0.0000963811
Contact a-length : 0.0169345
Contact b-length : 0.00205917
Contact area : 0.000109551
Distance to Corner: Dp : 0.00931546
Distance to Corner: Ds : 0.00931546
Effective Speed Factor : 2.659
Load-Life Factor : 13.9729

Expected Average Life : 1.44855 10⁸

Contact name : DsCi
Max Normal Load : 32.1833
Max Normal Stress : -263078.
Displacement : 0.000162644
Contact a-length : 0.0219987
Contact b-length : 0.00267475
Contact area : 0.000184854
Distance to Corner : 0.0350926
Effective Speed Factor : 2.659
Load-Life Factor : 6.60964

Expected Average Life : 7.25264 10⁶

```
=====
Ball number      : 7
Ball angle       : 290.
Ball position    : {-2.18867, 1.02059, 0.}
Solution current? : Yes
Ball activity     : ON
Ball request      : solve
Cross over angle  : 28.0919
Residual Force Vector : {0.247177, 0.472872, 0.180058}
Displacement Residual : 1.85249 10-6
****
Contact name      : DpCo
Max Normal Load   : 29.3207
Max Normal Stress : -254448.
Displacement      : 0.000152172
Contact a-length  : 0.0212787
Contact b-length  : 0.00258749
Contact area      : 0.000172971
Distance to Corner : 0.0358127
Effective Speed Factor : 2.659
Load-Life Factor   : 7.25495
Expected Average Life : 1.05274 107
****
Contact name      : DiCi
Max Normal Load   : 15.2235
Max Normal Stress : -202530.
Displacement      : 0.0000964038
Contact a-length  : 0.0169365
Contact b-length  : 0.00205941
Contact area      : 0.000109577
Distance to Corner: Dp : 0.00931347
Distance to Corner: Ds : 0.00931347
Effective Speed Factor : 2.659
Load-Life Factor   : 13.9731
Expected Average Life : 1.44864 108
****
Contact name      : DsCi
Max Normal Load   : 32.1266
Max Normal Stress : -262916.
Displacement      : 0.000162445
Contact a-length  : 0.0219852
Contact b-length  : 0.00267311
Contact area      : 0.000184628
Distance to Corner : 0.0351061
Effective Speed Factor : 2.659
Load-Life Factor   : 6.6213
Expected Average Life : 7.30391 106
```

```

=====
Ball number      : 8
Ball angle       : 280.
Ball position    : {-2.32091, 0.621885, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 28.1647
Residual Force Vector : {0.158914, 0.502463, 0.177644}
Displacement Residual : 1.8288 10-6
****
Contact name     : DpCo
Max Normal Load  : 29.2504
Max Normal Stress : -254245.
Displacement     : 0.000151929
Contact a-length : 0.0212617
Contact b-length : 0.00258542
Contact area     : 0.000172695
Distance to Corner : 0.0358296
Effective Speed Factor : 2.659
Load-Life Factor : 7.27237
Expected Average Life : 1.06289 107
****
Contact name     : DiCi
Max Normal Load  : 15.2231
Max Normal Stress : -202553.
Displacement     : 0.0000964257
Contact a-length : 0.0169385
Contact b-length : 0.00205965
Contact area     : 0.000109602
Distance to Corner: Dp : 0.00931153
Distance to Corner: Ds : 0.00931153
Effective Speed Factor : 2.659
Load-Life Factor : 13.9735
Expected Average Life : 1.44879 108
****
Contact name     : DsCi
Max Normal Load  : 32.0697
Max Normal Stress : -262755.
Displacement     : 0.000162245
Contact a-length : 0.0219717
Contact b-length : 0.00267146
Contact area     : 0.000184401
Distance to Corner : 0.0351197
Effective Speed Factor : 2.659
Load-Life Factor : 6.63304
Expected Average Life : 7.35589 106

```

=====

Ball number : 9
Ball angle : 270.
Ball position : {-2.38153, 0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.2377
Residual Force Vector : {0.0679635, 0.515946, 0.175229}

Displacement Residual : 1.80511 10⁻⁶

Contact name : DpCo
Max Normal Load : 29.18
Max Normal Stress : -254041.
Displacement : 0.000151685
Contact a-length : 0.0212446
Contact b-length : 0.00258335
Contact area : 0.000172418
Distance to Corner : 0.0358467
Effective Speed Factor : 2.659
Load-Life Factor : 7.28993

Expected Average Life : 1.07319 10⁷

Contact name : DiCi
Max Normal Load : 15.2225
Max Normal Stress : -202575.
Displacement : 0.000096447
Contact a-length : 0.0169403
Contact b-length : 0.00205988
Contact area : 0.000109626
Distance to Corner: Dp : 0.00930966
Distance to Corner: Ds : 0.00930966
Effective Speed Factor : 2.659
Load-Life Factor : 13.974

Expected Average Life : 1.449 10⁸

Contact name : DsCi
Max Normal Load : 32.0126
Max Normal Stress : -262592.
Displacement : 0.000162044
Contact a-length : 0.0219581
Contact b-length : 0.00266981
Contact area : 0.000184172
Distance to Corner : 0.0351333
Effective Speed Factor : 2.659
Load-Life Factor : 6.64489

Expected Average Life : 7.40857 10⁶

=====

Ball number : 10
Ball angle : 260.
Ball position : {-2.36942, -0.207298, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.3111
Residual Force Vector : {-0.022795, 0.5133, 0.172813}
Displacement Residual : 1.78143 10⁻⁶

Contact name : DpCo
Max Normal Load : 29.1092
Max Normal Stress : -253835.
Displacement : 0.00015144
Contact a-length : 0.0212275
Contact b-length : 0.00258126
Contact area : 0.000172139
Distance to Corner : 0.0358639
Effective Speed Factor : 2.659
Load-Life Factor : 7.30766

Expected Average Life : 1.08367 10⁷

Contact name : DiCi
Max Normal Load : 15.2218
Max Normal Stress : -202597.
Displacement : 0.0000964676
Contact a-length : 0.0169421
Contact b-length : 0.00206009
Contact area : 0.000109649
Distance to Corner: Dp : 0.00930786
Distance to Corner: Ds : 0.00930786
Effective Speed Factor : 2.659
Load-Life Factor : 13.9747

Expected Average Life : 1.44927 10⁸

Contact name : DsCi
Max Normal Load : 31.9551
Max Normal Stress : -262428.
Displacement : 0.000161841
Contact a-length : 0.0219444
Contact b-length : 0.00266814
Contact area : 0.000183943
Distance to Corner : 0.035147
Effective Speed Factor : 2.659
Load-Life Factor : 6.65683

Expected Average Life : 7.46198 10⁶

=====

Ball number : 11
Ball angle : 250.
Ball position : {-2.28569, -0.612449, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.3847
Residual Force Vector : {-0.110557, 0.495006, 0.170398}

-6
Displacement Residual : 1.75776 10

Contact name : DpCo
Max Normal Load : 29.0382
Max Normal Stress : -253629.
Displacement : 0.000151194
Contact a-length : 0.0212102
Contact b-length : 0.00257916
Contact area : 0.000171859
Distance to Corner : 0.0358812
Effective Speed Factor : 2.659
Load-Life Factor : 7.32553

7
Expected Average Life : 1.09431 10

Contact name : DiCi
Max Normal Load : 15.2209
Max Normal Stress : -202618.
Displacement : 0.0000964875
Contact a-length : 0.0169439
Contact b-length : 0.00206031
Contact area : 0.000109672
Distance to Corner: Dp : 0.00930611
Distance to Corner: Ds : 0.00930611
Effective Speed Factor : 2.659
Load-Life Factor : 13.9755

8
Expected Average Life : 1.44961 10

Contact name : DsCi
Max Normal Load : 31.8974
Max Normal Stress : -262263.
Displacement : 0.000161638
Contact a-length : 0.0219306
Contact b-length : 0.00266647
Contact area : 0.000183712
Distance to Corner : 0.0351608
Effective Speed Factor : 2.659
Load-Life Factor : 6.66888

6
Expected Average Life : 7.51613 10

```
=====
Ball number      : 12
Ball angle       : 240.
Ball position    : {-2.1336, -0.994914, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 28.4586
Residual Force Vector : {-0.192681, 0.462026, 0.167983}
                                     -6
Displacement Residual : 1.7341 10
****
Contact name      : DpCo
Max Normal Load   : 28.9668
Max Normal Stress : -253421.
Displacement      : 0.000150947
Contact a-length  : 0.0211928
Contact b-length  : 0.00257705
Contact area      : 0.000171578
Distance to Corner : 0.0358985
Effective Speed Factor : 2.659
Load-Life Factor  : 7.34357
                                     7
Expected Average Life : 1.10513 10
****
Contact name      : DiCi
Max Normal Load   : 15.2199
Max Normal Stress : -202638.
Displacement      : 0.0000965066
Contact a-length  : 0.0169456
Contact b-length  : 0.00206051
Contact area      : 0.000109694
Distance to Corner: Dp : 0.00930443
Distance to Corner: Ds : 0.00930443
Effective Speed Factor : 2.659
Load-Life Factor  : 13.9765
                                     8
Expected Average Life : 1.45001 10
****
Contact name      : DsCi
Max Normal Load   : 31.8395
Max Normal Stress : -262097.
Displacement      : 0.000161434
Contact a-length  : 0.0219167
Contact b-length  : 0.00266478
Contact area      : 0.000183479
Distance to Corner : 0.0351746
Effective Speed Factor : 2.659
Load-Life Factor  : 6.68102
                                     6
Expected Average Life : 7.57102 10
```


=====

Ball number : 13
Ball angle : 230.
Ball position : {-1.91847, -1.34332, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.5329
Residual Force Vector : {-0.266766, 0.415756, 0.165569}

Displacement Residual : 1.71045 10⁻⁶

Contact name : DpCo
Max Normal Load : 28.8953
Max Normal Stress : -253212.
Displacement : 0.000150698
Contact a-length : 0.0211754
Contact b-length : 0.00257492
Contact area : 0.000171295
Distance to Corner : 0.035916
Effective Speed Factor : 2.659
Load-Life Factor : 7.36176

Expected Average Life : 1.11612 10⁷

Contact name : DiCi
Max Normal Load : 15.2187
Max Normal Stress : -202657.
Displacement : 0.000096525
Contact a-length : 0.0169472
Contact b-length : 0.00206071
Contact area : 0.000109714
Distance to Corner: Dp : 0.00930281
Distance to Corner: Ds : 0.00930281
Effective Speed Factor : 2.659
Load-Life Factor : 13.9776

Expected Average Life : 1.45048 10⁸

Contact name : DsCi
Max Normal Load : 31.7812
Max Normal Stress : -261930.
Displacement : 0.000161229
Contact a-length : 0.0219028
Contact b-length : 0.00266309
Contact area : 0.000183246
Distance to Corner : 0.0351886
Effective Speed Factor : 2.659
Load-Life Factor : 6.69327

Expected Average Life : 7.62668 10⁶

```
=====
Ball number      : 14
Ball angle       : 220.
Ball position    : {-1.64746, -1.64746, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 28.6074
Residual Force Vector : {-0.330726, 0.357973, 0.163156}
Displacement Residual : 1.68682 10-6
****
Contact name     : DpCo
Max Normal Load  : 28.8234
Max Normal Stress : -253003.
Displacement     : 0.000150448
Contact a-length : 0.0211578
Contact b-length : 0.00257279
Contact area     : 0.000171011
Distance to Corner : 0.0359335
Effective Speed Factor : 2.659
Load-Life Factor : 7.38012
Expected Average Life : 1.12729 107
****
Contact name     : DiCi
Max Normal Load  : 15.2173
Max Normal Stress : -202676.
Displacement     : 0.0000965427
Contact a-length : 0.0169487
Contact b-length : 0.0020609
Contact area     : 0.000109735
Distance to Corner: Dp : 0.00930126
Distance to Corner: Ds : 0.00930126
Effective Speed Factor : 2.659
Load-Life Factor : 13.9788
Expected Average Life : 1.45101 108
****
Contact name     : DsCi
Max Normal Load  : 31.7227
Max Normal Stress : -261763.
Displacement     : 0.000161022
Contact a-length : 0.0218888
Contact b-length : 0.00266138
Contact area     : 0.000183012
Distance to Corner : 0.0352026
Effective Speed Factor : 2.659
Load-Life Factor : 6.70561
Expected Average Life : 7.68312 106
```

=====

Ball number : 15
Ball angle : 210.
Ball position : {-1.32938, -1.89856, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.6822
Residual Force Vector : {-0.382844, 0.29077, 0.160745}
Displacement Residual : 1.6632 10⁻⁶

Contact name : DpCo
Max Normal Load : 28.7513
Max Normal Stress : -252791.
Displacement : 0.000150197
Contact a-length : 0.0211402
Contact b-length : 0.00257064
Contact area : 0.000170726
Distance to Corner : 0.0359512
Effective Speed Factor : 2.659
Load-Life Factor : 7.39863

Expected Average Life : 1.13865 10⁷

Contact name : DiCi
Max Normal Load : 15.2157
Max Normal Stress : -202693.
Displacement : 0.0000965596
Contact a-length : 0.0169502
Contact b-length : 0.00206108
Contact area : 0.000109754
Distance to Corner: Dp : 0.00929978
Distance to Corner: Ds : 0.00929978
Effective Speed Factor : 2.659
Load-Life Factor : 13.9803

Expected Average Life : 1.4516 10⁸

Contact name : DsCi
Max Normal Load : 31.6639
Max Normal Stress : -261594.
Displacement : 0.000160815
Contact a-length : 0.0218747
Contact b-length : 0.00265967
Contact area : 0.000182776
Distance to Corner : 0.0352167
Effective Speed Factor : 2.659
Load-Life Factor : 6.71806

Expected Average Life : 7.74034 10⁶

=====

Ball number : 16
Ball angle : 200.
Ball position : {-0.97437, -2.08954, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.7573
Residual Force Vector : {-0.421819, 0.216481, 0.158335}

Displacement Residual : 1.63961 10⁻⁶

Contact name : DpCo
Max Normal Load : 28.6788
Max Normal Stress : -252579.
Displacement : 0.000149945
Contact a-length : 0.0211224
Contact b-length : 0.00256848
Contact area : 0.000170439
Distance to Corner : 0.0359689
Effective Speed Factor : 2.659
Load-Life Factor : 7.41731

Expected Average Life : 1.15019 10⁷

Contact name : DiCi
Max Normal Load : 15.214
Max Normal Stress : -202710.
Displacement : 0.0000965758
Contact a-length : 0.0169516
Contact b-length : 0.00206125
Contact area : 0.000109772
Distance to Corner: Dp : 0.00929836
Distance to Corner: Ds : 0.00929836
Effective Speed Factor : 2.659
Load-Life Factor : 13.9819

Expected Average Life : 1.45226 10⁸

Contact name : DsCi
Max Normal Load : 31.6048
Max Normal Stress : -261424.
Displacement : 0.000160606
Contact a-length : 0.0218605
Contact b-length : 0.00265794
Contact area : 0.000182539
Distance to Corner : 0.0352309
Effective Speed Factor : 2.659
Load-Life Factor : 6.73062

Expected Average Life : 7.79837 10⁶

=====

Ball number : 17
Ball angle : 190.
Ball position : {-0.593576, -2.21526, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 28.8327
Residual Force Vector : {-0.446795, 0.137601, 0.155928}

-6

Displacement Residual : 1.61604 10

Contact name : DpCo
Max Normal Load : 28.6062
Max Normal Stress : -252366.
Displacement : 0.000149692
Contact a-length : 0.0211045
Contact b-length : 0.00256631
Contact area : 0.000170151
Distance to Corner : 0.0359868
Effective Speed Factor : 2.659
Load-Life Factor : 7.43616

7

Expected Average Life : 1.16193 10

Contact name : DiCi
Max Normal Load : 15.2121
Max Normal Stress : -202726.
Displacement : 0.0000965912
Contact a-length : 0.016953
Contact b-length : 0.00206141
Contact area : 0.00010979
Distance to Corner: Dp : 0.00929701
Distance to Corner: Ds : 0.00929701
Effective Speed Factor : 2.659
Load-Life Factor : 13.9836

8

Expected Average Life : 1.45299 10

Contact name : DsCi
Max Normal Load : 31.5455
Max Normal Stress : -261254.
Displacement : 0.000160397
Contact a-length : 0.0218462
Contact b-length : 0.00265621
Contact area : 0.000182301
Distance to Corner : 0.0352451
Effective Speed Factor : 2.659
Load-Life Factor : 6.74328

6

Expected Average Life : 7.85722 10

=====

Ball number : 18
Ball angle : 180.
Ball position : {-0.198824, -2.27257, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.6486
Residual Force Vector : {-0.217299, 0.0157389, 0.00292947}

-7
Displacement Residual : 9.31768 10

Contact name : DpCi
Max Normal Load : 30.028
Max Normal Stress : -256584.
Displacement : 0.000154724
Contact a-length : 0.0214564
Contact b-length : 0.00260892
Contact area : 0.00017586
Distance to Corner : 0.035635
Effective Speed Factor : 2.659
Load-Life Factor : 7.08405

6
Expected Average Life : 9.56995 10

Contact name : DiCi
Max Normal Load : 12.8951
Max Normal Stress : -192469.
Displacement : 0.0000870639
Contact a-length : 0.0160952
Contact b-length : 0.00195711
Contact area : 0.0000989605
Distance to Corner: Dp : 0.0101548
Distance to Corner: Ds : 0.0101548
Effective Speed Factor : 2.659
Load-Life Factor : 16.4962

8
Expected Average Life : 2.81394 10

Contact name : DsCo
Max Normal Load : 33.3267
Max Normal Stress : -265617.
Displacement : 0.000165834
Contact a-length : 0.0222134
Contact b-length : 0.00270126
Contact area : 0.000188508
Distance to Corner : 0.034878
Effective Speed Factor : 2.659
Load-Life Factor : 6.38287

6
Expected Average Life : 6.30734 10

=====

Ball number : 19
Ball angle : 170.
Ball position : {0.199883, -2.28468, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.5709
Residual Force Vector : {-0.21445, -0.0219824, 0.00270928}
Displacement Residual : 9.22815 10⁻⁷

Contact name : DpCi
Max Normal Load : 30.1052
Max Normal Stress : -256802.
Displacement : 0.000154987
Contact a-length : 0.0214746
Contact b-length : 0.00261114
Contact area : 0.000176159
Distance to Corner : 0.0356167
Effective Speed Factor : 2.659
Load-Life Factor : 7.06589

Expected Average Life : 9.47219 10⁶

Contact name : DiCi
Max Normal Load : 12.882
Max Normal Stress : -192412.
Displacement : 0.0000870128
Contact a-length : 0.0160905
Contact b-length : 0.00195654
Contact area : 0.0000989024
Distance to Corner: Dp : 0.0101595
Distance to Corner: Ds : 0.0101595
Effective Speed Factor : 2.659
Load-Life Factor : 16.513

Expected Average Life : 2.82542 10⁸

Contact name : DsCo
Max Normal Load : 33.3931
Max Normal Stress : -265791.
Displacement : 0.000166052
Contact a-length : 0.0222279
Contact b-length : 0.00270303
Contact area : 0.000188755
Distance to Corner : 0.0348635
Effective Speed Factor : 2.659
Load-Life Factor : 6.37019

Expected Average Life : 6.25738 10⁶

```
=====
Ball number      : 20
Ball angle       : 160.
Ball position    : {0.596722, -2.227, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 23.4935
Residual Force Vector : {-0.205222, -0.05826, 0.00249814}
Displacement Residual : 9.14064 10-7
****
Contact name     : DpCi
Max Normal Load  : 30.1821
Max Normal Stress : -257019.
Displacement     : 0.000155248
Contact a-length : 0.0214927
Contact b-length : 0.00261334
Contact area     : 0.000176456
Distance to Corner : 0.0355986
Effective Speed Factor : 2.659
Load-Life Factor : 7.04789
Expected Average Life : 9.37606 106
****
Contact name     : DiCi
Max Normal Load  : 12.8688
Max Normal Stress : -192355.
Displacement     : 0.0000869609
Contact a-length : 0.0160857
Contact b-length : 0.00195595
Contact area     : 0.0000988434
Distance to Corner: Dp : 0.0101643
Distance to Corner: Ds : 0.0101643
Effective Speed Factor : 2.659
Load-Life Factor : 16.53
Expected Average Life : 2.83708 108
****
Contact name     : DsCo
Max Normal Load  : 33.459
Max Normal Stress : -265964.
Displacement     : 0.000166268
Contact a-length : 0.0222423
Contact b-length : 0.00270478
Contact area     : 0.000189
Distance to Corner : 0.034849
Effective Speed Factor : 2.659
Load-Life Factor : 6.35762
Expected Average Life : 6.20816 106
```


=====

Ball number : 21
Ball angle : 150.
Ball position : {0.979506, -2.10056, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.4165
Residual Force Vector : {-0.190021, -0.0920436, 0.00229561}

-7
Displacement Residual : 9.05505 10

Contact name : DpCi
Max Normal Load : 30.2586
Max Normal Stress : -257234.
Displacement : 0.000155508
Contact a-length : 0.0215107
Contact b-length : 0.00261553
Contact area : 0.000176752
Distance to Corner : 0.0355806
Effective Speed Factor : 2.659
Load-Life Factor : 7.03006

6
Expected Average Life : 9.28155 10

Contact name : DiCi
Max Normal Load : 12.8554
Max Normal Stress : -192297.
Displacement : 0.0000869082
Contact a-length : 0.0160808
Contact b-length : 0.00195536
Contact area : 0.0000987836
Distance to Corner: Dp : 0.0101692
Distance to Corner: Ds : 0.0101692
Effective Speed Factor : 2.659
Load-Life Factor : 16.5472

8
Expected Average Life : 2.8489 10

Contact name : DsCo
Max Normal Load : 33.5247
Max Normal Stress : -266135.
Displacement : 0.000166482
Contact a-length : 0.0222567
Contact b-length : 0.00270653
Contact area : 0.000189245
Distance to Corner : 0.0348346
Effective Speed Factor : 2.659
Load-Life Factor : 6.34517

6
Expected Average Life : 6.15966 10

```
=====
Ball number      : 22
Ball angle       : 140.
Ball position    : {1.33635, -1.90851, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 23.3397
Residual Force Vector : {-0.16942, -0.122377, 0.0021013}
Displacement Residual : 8.97131 10-7
****
Contact name     : DpCi
Max Normal Load  : 30.3348
Max Normal Stress : -257448.
Displacement     : 0.000155767
Contact a-length : 0.0215286
Contact b-length : 0.0026177
Contact area     : 0.000177046
Distance to Corner : 0.0355627
Effective Speed Factor : 2.659
Load-Life Factor : 7.0124
Expected Average Life : 9.18862 106
****
Contact name     : DiCi
Max Normal Load  : 12.8419
Max Normal Stress : -192238.
Displacement     : 0.0000868548
Contact a-length : 0.0160759
Contact b-length : 0.00195476
Contact area     : 0.0000987228
Distance to Corner: Dp : 0.0101741
Distance to Corner: Ds : 0.0101741
Effective Speed Factor : 2.659
Load-Life Factor : 16.5646
Expected Average Life : 2.8609 108
****
Contact name     : DsCo
Max Normal Load  : 33.59
Max Normal Stress : -266306.
Displacement     : 0.000166696
Contact a-length : 0.022271
Contact b-length : 0.00270826
Contact area     : 0.000189487
Distance to Corner : 0.0348204
Effective Speed Factor : 2.659
Load-Life Factor : 6.33283
Expected Average Life : 6.11187 106
```

=====

Ball number : 23
Ball angle : 130.
Ball position : {1.65605, -1.65605, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.2633
Residual Force Vector : {-0.144142, -0.148427, 0.00191485}
Displacement Residual : 8.88937 10⁻⁷

Contact name : DpCi
Max Normal Load : 30.4107
Max Normal Stress : -257661.
Displacement : 0.000156025
Contact a-length : 0.0215464
Contact b-length : 0.00261987
Contact area : 0.000177339
Distance to Corner : 0.0355449
Effective Speed Factor : 2.659
Load-Life Factor : 6.9949

Expected Average Life : 9.09723 10⁶

Contact name : DiCi
Max Normal Load : 12.8283
Max Normal Stress : -192178.
Displacement : 0.0000868006
Contact a-length : 0.0160709
Contact b-length : 0.00195415
Contact area : 0.0000986612
Distance to Corner: Dp : 0.0101791
Distance to Corner: Ds : 0.0101791
Effective Speed Factor : 2.659
Load-Life Factor : 16.5821

Expected Average Life : 2.87307 10⁸

Contact name : DsCo
Max Normal Load : 33.6551
Max Normal Stress : -266476.
Displacement : 0.000166908
Contact a-length : 0.0222852
Contact b-length : 0.00270999
Contact area : 0.000189729
Distance to Corner : 0.0348062
Effective Speed Factor : 2.659
Load-Life Factor : 6.3206

Expected Average Life : 6.06479 10⁶

```
=====
Ball number      : 24
Ball angle       : 120.
Ball position    : {1.92842, -1.35029, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 23.1872
Residual Force Vector : {-0.115032, -0.169499, 0.00173589}
Displacement Residual : 8.80914 10-7
****
Contact name     : DpCi
Max Normal Load  : 30.4863
Max Normal Stress : -257872.
Displacement     : 0.000156281
Contact a-length : 0.0215641
Contact b-length : 0.00262202
Contact area     : 0.00017763
Distance to Corner : 0.0355273
Effective Speed Factor : 2.659
Load-Life Factor : 6.97756
Expected Average Life : 9.00736 106
****
Contact name     : DiCi
Max Normal Load  : 12.8145
Max Normal Stress : -192117.
Displacement     : 0.0000867457
Contact a-length : 0.0160658
Contact b-length : 0.00195353
Contact area     : 0.0000985988
Distance to Corner: Dp : 0.0101842
Distance to Corner: Ds : 0.0101842
Effective Speed Factor : 2.659
Load-Life Factor : 16.5999
Expected Average Life : 2.88541 108
****
Contact name     : DsCo
Max Normal Load  : 33.7197
Max Normal Stress : -266644.
Displacement     : 0.00016712
Contact a-length : 0.0222993
Contact b-length : 0.0027117
Contact area     : 0.000189969
Distance to Corner : 0.0347921
Effective Speed Factor : 2.659
Load-Life Factor : 6.30847
Expected Average Life : 6.01839 106
```

=====

Ball number : 25
Ball angle : 110.
Ball position : {2.14461, -1.00005, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.1113
Residual Force Vector : {-0.0830355, -0.185063, 0.0015641}
Displacement Residual : 8.73057 10⁻⁷

Contact name : DpCi
Max Normal Load : 30.5616
Max Normal Stress : -258083.
Displacement : 0.000156536
Contact a-length : 0.0215817
Contact b-length : 0.00262416
Contact area : 0.00017792
Distance to Corner : 0.0355097
Effective Speed Factor : 2.659
Load-Life Factor : 6.96038

Expected Average Life : 8.91897 10⁶

Contact name : DiCi
Max Normal Load : 12.8007
Max Normal Stress : -192055.
Displacement : 0.00008669
Contact a-length : 0.0160606
Contact b-length : 0.0019529
Contact area : 0.0000985355
Distance to Corner: Dp : 0.0101894
Distance to Corner: Ds : 0.0101894
Effective Speed Factor : 2.659
Load-Life Factor : 16.6179

Expected Average Life : 2.89793 10⁸

Contact name : DsCo
Max Normal Load : 33.7841
Max Normal Stress : -266812.
Displacement : 0.00016733
Contact a-length : 0.0223133
Contact b-length : 0.00271341
Contact area : 0.000190208
Distance to Corner : 0.0347781
Effective Speed Factor : 2.659
Load-Life Factor : 6.29646

Expected Average Life : 5.97266 10⁶

=====

Ball number : 26
Ball angle : 100.
Ball position : {2.29743, -0.615594, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 23.0358
Residual Force Vector : {-0.0491617, -0.194762, 0.00139917}

-7
Displacement Residual : 8.65359 10

Contact name : DpCi
Max Normal Load : 30.6365
Max Normal Stress : -258292.
Displacement : 0.00015679
Contact a-length : 0.0215992
Contact b-length : 0.00262628
Contact area : 0.000178208
Distance to Corner : 0.0354922
Effective Speed Factor : 2.659
Load-Life Factor : 6.94335

6
Expected Average Life : 8.83204 10

Contact name : DiCi
Max Normal Load : 12.7867
Max Normal Stress : -191993.
Displacement : 0.0000866336
Contact a-length : 0.0160554
Contact b-length : 0.00195227
Contact area : 0.0000984714
Distance to Corner: Dp : 0.0101946
Distance to Corner: Ds : 0.0101946
Effective Speed Factor : 2.659
Load-Life Factor : 16.6361

8
Expected Average Life : 2.91062 10

Contact name : DsCo
Max Normal Load : 33.8481
Max Normal Stress : -266978.
Displacement : 0.000167539
Contact a-length : 0.0223272
Contact b-length : 0.0027151
Contact area : 0.000190445
Distance to Corner : 0.0347641
Effective Speed Factor : 2.659
Load-Life Factor : 6.28454

6
Expected Average Life : 5.9276 10

=====

Ball number : 27
Ball angle : 90.
Ball position : {2.38153, -0.208357, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 22.9606
Residual Force Vector : {-0.0144586, -0.198417, 0.00124079}

-7
Displacement Residual : 8.57815 10

Contact name : DpCi
Max Normal Load : 30.7111
Max Normal Stress : -258500.
Displacement : 0.000157042
Contact a-length : 0.0216165
Contact b-length : 0.00262839
Contact area : 0.000178495
Distance to Corner : 0.0354748
Effective Speed Factor : 2.659
Load-Life Factor : 6.92649

6
Expected Average Life : 8.74653 10

Contact name : DiCi
Max Normal Load : 12.7726
Max Normal Stress : -191929.
Displacement : 0.0000865765
Contact a-length : 0.0160501
Contact b-length : 0.00195163
Contact area : 0.0000984065
Distance to Corner: Dp : 0.0101999
Distance to Corner: Ds : 0.0101999
Effective Speed Factor : 2.659
Load-Life Factor : 16.6544

8
Expected Average Life : 2.9235 10

Contact name : DsCo
Max Normal Load : 33.9118
Max Normal Stress : -267144.
Displacement : 0.000167747
Contact a-length : 0.0223411
Contact b-length : 0.00271679
Contact area : 0.000190682
Distance to Corner : 0.0347503
Effective Speed Factor : 2.659
Load-Life Factor : 6.27274

6
Expected Average Life : 5.88319 10

```
=====
Ball number      : 28
Ball angle       : 80.
Ball position    : {2.39363, 0.209416, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 22.8857
Residual Force Vector : {0.0200215, -0.196035, 0.00108868}
                                     -7
Displacement Residual : 8.50419 10
****
Contact name      : DpCi
Max Normal Load   : 30.7854
Max Normal Stress : -258707.
Displacement      : 0.000157294
Contact a-length  : 0.0216338
Contact b-length  : 0.0026305
Contact area      : 0.000178781
Distance to Corner : 0.0354575
Effective Speed Factor : 2.659
Load-Life Factor  : 6.90977
                                     6
Expected Average Life : 8.66241 10
****
Contact name      : DiCi
Max Normal Load   : 12.7584
Max Normal Stress : -191865.
Displacement      : 0.0000865187
Contact a-length  : 0.0160447
Contact b-length  : 0.00195097
Contact area      : 0.0000983408
Distance to Corner: Dp : 0.0102053
Distance to Corner: Ds : 0.0102053
Effective Speed Factor : 2.659
Load-Life Factor  : 16.673
                                     8
Expected Average Life : 2.93655 10
****
Contact name      : DsCo
Max Normal Load   : 33.9752
Max Normal Stress : -267308.
Displacement      : 0.000167953
Contact a-length  : 0.0223548
Contact b-length  : 0.00271846
Contact area      : 0.000190917
Distance to Corner : 0.0347365
Effective Speed Factor : 2.659
Load-Life Factor  : 6.26104
                                     6
Expected Average Life : 5.83941 10
```


=====

Ball number : 29
Ball angle : 70.
Ball position : {2.33264, 0.62503, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 22.8111
Residual Force Vector : {0.053252, -0.187799, 0.000942587}

-7
Displacement Residual : 8.43166 10

Contact name : DpCi
Max Normal Load : 30.8593
Max Normal Stress : -258912.
Displacement : 0.000157543
Contact a-length : 0.021651
Contact b-length : 0.00263258
Contact area : 0.000179065
Distance to Corner : 0.0354403
Effective Speed Factor : 2.659
Load-Life Factor : 6.89321

6
Expected Average Life : 8.57966 10

Contact name : DiCi
Max Normal Load : 12.744
Max Normal Stress : -191800.
Displacement : 0.0000864602
Contact a-length : 0.0160393
Contact b-length : 0.00195031
Contact area : 0.0000982744
Distance to Corner: Dp : 0.0102107
Distance to Corner: Ds : 0.0102107
Effective Speed Factor : 2.659
Load-Life Factor : 16.6917

8
Expected Average Life : 2.94978 10

Contact name : DsCo
Max Normal Load : 34.0383
Max Normal Stress : -267472.
Displacement : 0.000168159
Contact a-length : 0.0223685
Contact b-length : 0.00272012
Contact area : 0.00019115
Distance to Corner : 0.0347229
Effective Speed Factor : 2.659
Load-Life Factor : 6.24944

6
Expected Average Life : 5.79626 10

=====

Ball number : 30
 Ball angle : 60.
 Ball position : {2.19968, 1.02573, 0.}
 Solution current? : Yes
 Ball activity : ON
 Ball request : solve
 Cross over angle : 22.7368
 Residual Force Vector : {0.0842627, -0.174064, 0.000802246}

-7
 Displacement Residual : 8.36051 10

Contact name : DpCi
 Max Normal Load : 30.933
 Max Normal Stress : -259116.
 Displacement : 0.000157792
 Contact a-length : 0.0216681
 Contact b-length : 0.00263466
 Contact area : 0.000179347
 Distance to Corner : 0.0354233
 Effective Speed Factor : 2.659
 Load-Life Factor : 6.8768

6
 Expected Average Life : 8.49825 10

Contact name : DiCi
 Max Normal Load : 12.7296
 Max Normal Stress : -191735.
 Displacement : 0.000086401
 Contact a-length : 0.0160338
 Contact b-length : 0.00194965
 Contact area : 0.0000982071
 Distance to Corner: Dp : 0.0102162
 Distance to Corner: Ds : 0.0102162
 Effective Speed Factor : 2.659
 Load-Life Factor : 16.7107

8
 Expected Average Life : 2.9632 10

Contact name : DsCo
 Max Normal Load : 34.101
 Max Normal Stress : -267634.
 Displacement : 0.000168363
 Contact a-length : 0.0223821
 Contact b-length : 0.00272178
 Contact area : 0.000191383
 Distance to Corner : 0.0347093
 Effective Speed Factor : 2.659
 Load-Life Factor : 6.23794

6
 Expected Average Life : 5.75372 10

=====

Ball number : 31
Ball angle : 50.
Ball position : {1.99811, 1.39909, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 22.6628
Residual Force Vector : {0.112167, -0.155343, 0.000667422}

-7
Displacement Residual : 8.2907 10

Contact name : DpCi
Max Normal Load : 31.0063
Max Normal Stress : -259319.
Displacement : 0.000158039
Contact a-length : 0.0216851
Contact b-length : 0.00263672
Contact area : 0.000179628
Distance to Corner : 0.0354063
Effective Speed Factor : 2.659
Load-Life Factor : 6.86054

6
Expected Average Life : 8.41816 10

Contact name : DiCi
Max Normal Load : 12.715
Max Normal Stress : -191668.
Displacement : 0.0000863412
Contact a-length : 0.0160283
Contact b-length : 0.00194897
Contact area : 0.0000981391
Distance to Corner: Dp : 0.0102217
Distance to Corner: Ds : 0.0102217
Effective Speed Factor : 2.659
Load-Life Factor : 16.7298

8
Expected Average Life : 2.9768 10

Contact name : DsCo
Max Normal Load : 34.1634
Max Normal Stress : -267796.
Displacement : 0.000168566
Contact a-length : 0.0223956
Contact b-length : 0.00272342
Contact area : 0.000191614
Distance to Corner : 0.0346958
Effective Speed Factor : 2.659
Load-Life Factor : 6.22654

6
Expected Average Life : 5.71178 10

```

=====
Ball number      : 32
Ball angle       : 40.
Ball position    : {1.73339, 1.73339, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 22.5891
Residual Force Vector : {0.136185, -0.132286, 0.000537887}
Displacement Residual : 8.22216 10
****
Contact name     : DpCi
Max Normal Load  : 31.0793
Max Normal Stress : -259521.
Displacement     : 0.000158286
Contact a-length : 0.0217019
Contact b-length : 0.00263878
Contact area     : 0.000179908
Distance to Corner : 0.0353894
Effective Speed Factor : 2.659
Load-Life Factor : 6.84443
Expected Average Life : 8.33935 10
****
Contact name     : DiCi
Max Normal Load  : 12.7003
Max Normal Stress : -191601.
Displacement     : 0.0000862807
Contact a-length : 0.0160226
Contact b-length : 0.00194829
Contact area     : 0.0000980703
Distance to Corner: Dp : 0.0102274
Distance to Corner: Ds : 0.0102274
Effective Speed Factor : 2.659
Load-Life Factor : 16.7492
Expected Average Life : 2.99059 10
****
Contact name     : DsCo
Max Normal Load  : 34.2255
Max Normal Stress : -267956.
Displacement     : 0.000168769
Contact a-length : 0.022409
Contact b-length : 0.00272505
Contact area     : 0.000191843
Distance to Corner : 0.0346823
Effective Speed Factor : 2.659
Load-Life Factor : 6.21525
Expected Average Life : 5.67044 10

```

=====

Ball number : 33
Ball angle : 30.
Ball position : {1.41303, 2.01802, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 22.5157
Residual Force Vector : {0.15567, -0.105662, 0.000413426}
Displacement Residual : 8.15487 10⁻⁷

Contact name : DpCi
Max Normal Load : 31.152
Max Normal Stress : -259722.
Displacement : 0.00015853
Contact a-length : 0.0217187
Contact b-length : 0.00264082
Contact area : 0.000180186
Distance to Corner : 0.0353726
Effective Speed Factor : 2.659
Load-Life Factor : 6.82846

Expected Average Life : 8.2618 10⁶

Contact name : DiCi
Max Normal Load : 12.6855
Max Normal Stress : -191533.
Displacement : 0.0000862195
Contact a-length : 0.016017
Contact b-length : 0.0019476
Contact area : 0.0000980007
Distance to Corner: Dp : 0.010233
Distance to Corner: Ds : 0.010233
Effective Speed Factor : 2.659
Load-Life Factor : 16.7687

Expected Average Life : 3.00456 10⁸

Contact name : DsCo
Max Normal Load : 34.2873
Max Normal Stress : -268116.
Displacement : 0.00016897
Contact a-length : 0.0224223
Contact b-length : 0.00272667
Contact area : 0.000192072
Distance to Corner : 0.034669
Effective Speed Factor : 2.659
Load-Life Factor : 6.20405

Expected Average Life : 5.62968 10⁶

=====

Ball number : 34
Ball angle : 20.
Ball position : {1.04627, 2.24374, 0.}
Solution current? : Yes
Ball activity : ON
Ball request : solve
Cross over angle : 22.4426
Residual Force Vector : {0.170118, -0.0763317, 0.000293833}

-7
Displacement Residual : 8.08878 10

Contact name : DpCi
Max Normal Load : 31.2243
Max Normal Stress : -259921.
Displacement : 0.000158774
Contact a-length : 0.0217354
Contact b-length : 0.00264284
Contact area : 0.000180463
Distance to Corner : 0.0353559
Effective Speed Factor : 2.659
Load-Life Factor : 6.81264

6
Expected Average Life : 8.18549 10

Contact name : DiCi
Max Normal Load : 12.6706
Max Normal Stress : -191465.
Displacement : 0.0000861576
Contact a-length : 0.0160112
Contact b-length : 0.0019469
Contact area : 0.0000979304
Distance to Corner: Dp : 0.0102388
Distance to Corner: Ds : 0.0102388
Effective Speed Factor : 2.659
Load-Life Factor : 16.7884

8
Expected Average Life : 3.01871 10

Contact name : DsCo
Max Normal Load : 34.3488
Max Normal Stress : -268274.
Displacement : 0.000169169
Contact a-length : 0.0224356
Contact b-length : 0.00272829
Contact area : 0.000192299
Distance to Corner : 0.0346557
Effective Speed Factor : 2.659
Load-Life Factor : 6.19294

6
Expected Average Life : 5.58949 10

```

=====
Ball number      : 36
Ball angle       : 0.
Ball position    : {0.217889, 2.49049, 0.}
Solution current? : Yes
Ball activity    : ON
Ball request     : solve
Cross over angle : 27.5906
Residual Force Vector : {0.57387, -0.0797235, 0.196918}
                                     -6
Displacement Residual : 2.01813 10
****
Contact name      : DpCo
Max Normal Load   : 29.8044
Max Normal Stress : -255837.
Displacement      : 0.000153839
Contact a-length  : 0.0213949
Contact b-length  : 0.00260162
Contact area      : 0.000174866
Distance to Corner : 0.0356965
Effective Speed Factor : 2.659
Load-Life Factor  : 7.13721
                                     6
Expected Average Life : 9.86046 10
****
Contact name      : DiCi
Max Normal Load   : 15.2218
Max Normal Stress : -202348.
Displacement      : 0.0000962309
Contact a-length  : 0.0169213
Contact b-length  : 0.00205757
Contact area      : 0.00010938
Distance to Corner: Dp : 0.00932866
Distance to Corner: Ds : 0.00932866
Effective Speed Factor : 2.659
Load-Life Factor  : 13.9747
                                     8
Expected Average Life : 1.44928 10
****
Contact name      : DsCi
Max Normal Load   : 32.5175
Max Normal Stress : -264024.
Displacement      : 0.000163817
Contact a-length  : 0.0220779
Contact b-length  : 0.00268437
Contact area      : 0.000186187
Distance to Corner : 0.0350135
Effective Speed Factor : 2.659
Load-Life Factor  : 6.54171
                                     6
Expected Average Life : 6.95903 10

```

=====
Summary of Performance
=====

Applied Angular Twist (degrees) : 0.599969

Total Internal Loads (Fx,Fy,Fz)

Primary Disk : {-351.092, 65.1845, -920.724}
Intermediate Disk : {15.9569, -29.5115, -16.7809}
Secondary Disk : {333.907, -39.1693, 934.303}

Total Axial Torque (Tz)

Primary Disk : 32.7714
Intermediate Disk : 1197.69
Secondary Disk : -1199.24

Torque Ratio: Ds/Dp : 36.5941
Torque Ratio: Di/Dp : 36.5467
Torque Ratio: Di/Ds : 0.998705

Torsional Stiffness (T/rad) : 114525.

Average Residual Force : {0.0341081, 0.0971192, 0.0889187}
-6

Average Displacement Residual : 1.34031 10

Dp Speed : 10.
Ds Speed : 0.27027
Speed Conversion Ratio : 37.
Effective N.D. Speed : 20.
Minimum Expected Average Life

hours : 8.11039 10⁶
years : 925.843

Average Load-Life Factor: Dp : 7.11009
Average Load-Life Factor: Di : 15.3118
Average Load-Life Factor: Ds : 6.46015

=====
Summary of Extreme Values
=====

Maximum Compressive Contact Stress Dp	: -260120.
At ball number	: 35
Maximum Compressive Contact Stress Di	: -202726.
At ball number	: 17
Maximum Compressive Contact Stress Ds	: -264024.
At ball number	: 36
Maximum Ball Deflection Dp	: 0.000159016
At ball number	: 35
Maximum Ball Deflection Di	: 0.0000965912
At ball number	: 17
Maximum Ball Deflection Ds	: 0.000169368
At ball number	: 35
Maximum Ball Contact Area Dp	: 0.000180739
At ball number	: 35
Maximum Ball Contact Area Di	: 0.00010979
At ball number	: 17
Maximum Ball Contact Area Ds	: 0.000192525
At ball number	: 35
Maximum Ball a-patch Dp	: 0.021752
At ball number	: 35
Maximum Ball a-patch Di	: 0.016953
At ball number	: 17
Maximum Ball a-patch Ds	: 0.0224488
At ball number	: 35
Maximum Ball b-patch Dp	: 0.00264486
At ball number	: 35
Maximum Ball b-patch Di	: 0.00206141
At ball number	: 17
Maximum Ball b-patch Ds	: 0.00272989
At ball number	: 35
Minimum Distance to Dp Corner	: 0.0353394
At ball number	: 35
Minimum Distance to Di Corner: Dp	: 0.00929701
At ball number	: 17
Minimum Distance to Di Corner: Ds	: 0.00929701
At ball number	: 17
Minimum Distance to Ds Corner	: 0.0346426
At ball number	: 35

=====
=====